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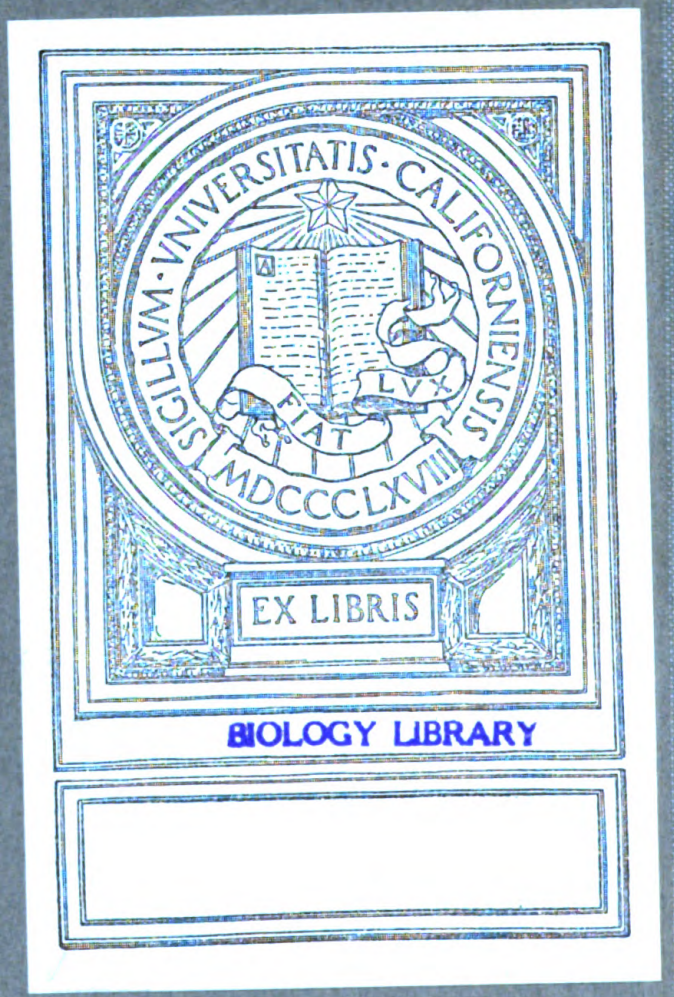


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NAVY DEPARTMENT
WASHINGTON, D. C.

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COVER PHOTOGRAPH

Sea, land, and sky blend with the tenderness of rugged hands in this scene of a casual being swung from a ramp boat to a ship in Massacre Bay, Attu.

—Official U. S. Navy Photo

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

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ROSS T MCINTIRE,
Surgeon General, United States Navy.

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The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have them typewritten.

In submitting articles for publication the author should include a signed statement to the effect that "the opinions or assertions contained therein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large." (Art. 113 (2) U. S. Navy Regulations.)

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The editor regrets to have to say that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANSDELL, *Editor*,
Commander, Medical Corps,
United States Naval Reserve.
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Lieutenant Commander, Medical Corps,
United States Naval Reserve.

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U. S. NAVAL MEDICAL BULLETIN

VOL. XLII JANUARY 1944 No. 1

SPECIAL ARTICLES

CHEMOTHERAPY IN THE MANAGEMENT OF ACUTE APPENDICITIS

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Commander (MC) U. S. N. R.
and
HARRY C. WATKINS
Lieutenant Commander (MC) U. S. N. R.

The postoperative complications which one encounters in base hospitals as sequelae of appendectomies done at sea, emphasize the serious additional risk and hazard associated with this relatively simple surgical procedure when performed under unfavorable circumstances. Many medical officers have become convinced that any conservative method of therapy which would either abort the attack or promote quiescence until the operating conditions could be reversed from unfavorable to favorable, would be desirable.

Sulfonamide compounds, we believe, may accomplish this and enable us to make a satisfactory therapeutic approach to the problem. This belief is strengthened by the favorable reports which indicate the effectiveness of this type of therapy in abscess formations, peritonitis, and postoperative wound infections, when these occur as complications of acute appendicitis. It is reasonable, therefore, to believe that chemotherapy would be even more beneficial in the very early stage, before the pathological process has dangerously advanced.

An effort to determine the degree of effectiveness of sulfonamide therapy in the early stages of acute appendicitis has recently been made by us.

A study, covering a period of 16 months, has been carried on in connection with routine duties aboard a United States naval transport operating under wartime conditions and carrying a complement of approximately 1,500 personnel. These fell chiefly within the age group in which the disease occurs with the greatest frequency. During this period, a close study was made of all cases of abdominal complaints coming to the sickbay. All those cases presenting either positive or

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suggestive signs and symptoms of acute appendicitis were admitted to the sick list and placed on sulfonamide therapy. There was a total of 20 such cases admitted, 8 of which presented sufficient clinical and laboratory evidence to be diagnosed acute appendicitis. The diagnoses of the other 12 cases were questionable. Further study and observation revealed these to be seasickness in 4, acute gastro-enteritis in 3, right ureteral calculus in 1, conversion neurosis in 1, and questionable acute appendicitis in 3.

The 8 cases diagnosed as acute appendicitis were admitted within 2 to 6 hours after onset of symptoms and were under close observation by the medical officer. White and differential blood counts were made at 6-hour intervals on each case. On admission, 7 cases were given sulfathiazole, 2 gm. as an initial dose, followed by a maintenance dosage of 1 gm. four times a day. In 1 case sulfanilamide was given in the same dosage. All received liquids by mouth.

The symptoms and findings remained the same in some cases and in others became more pronounced for the first 12 hours. All cases showed a progressive diminution of pain, tenderness, and rigidity after the first 12 hours. There was also a progressive decrease of the white blood cell count to normal. Within 24 hours the subjective symptoms in all cases had disappeared. Residual tenderness over the appendiceal area persisted 2 to 4 days.

The other 12 cases admitted, in which acute abdominal pain was the chief complaint, were placed on the same treatment as those having acute appendicitis. This treatment was discontinued as soon as a positive diagnosis was made. In 2 cases of questionable appendicitis, the subjective and objective symptoms disappeared within 48 hours under this treatment. In the third (case 4), residual tenderness persisted for over 5 days. No untoward effects from this treatment were encountered except that 1 case developed a mild generalized drug rash which cleared within 24 hours after the sulfathiazole was discontinued.

Because of the history of previous recurring attacks, or for other reasons, 4 cases were transferred to naval hospital for interval operations. No operations for appendicitis were performed or considered necessary aboard this vessel during the period of this study.

This study has not been made in an attempt to discredit properly done appendectomies under favorable conditions and on correctly diagnosed cases. We consider the patient with acute appendicitis most fortunate when he finds himself under the care of a conscientious surgeon with diagnostic ability and correct operative technic acquired through experience. However, we must realistically face the fact that under wartime conditions more often than not the surgeon finds himself confronted with problems not of his choosing. His difficulties

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are likely to be magnified and the patient's welfare jeopardized by poor or deficient equipment, unfavorable weather conditions, unskilled assistants, and postoperative hazards due to enemy action. It is unfortunate that the patient with acute appendicitis sometimes has to chance this unfavorable and unavoidable situation, but it is tragic when in the extreme case he finds himself the subject of an experiment, and that in the hands of untrained operators. While such a feat may be pictured as a heroic exploit and publicized by the press as an example of American ingenuity, it nevertheless represents a type of assault to be vigorously condemned. Under conservative medical care, the patient will survive the disease itself in a greater percentage of cases than he will survive such acts of rashness.

Since under wartime conditions these factors, unfavorable for the optimum surgical results, are apt to continue to exist, a nonsurgical approach to the problem would seem to be the logical answer. Chemotherapy apparently gives this answer by changing acute appendicitis from a surgical emergency to a condition of simple medication, and without additional risk to the patient, time is gained for further observation and more accurate diagnosis. Subsequent study and development will often reveal such conditions as seasickness, acute enteritis, ureteral stone, allergy with gastro-intestinal symptoms, conversion neurosis, and other less common conditions. Chemotherapy may be used in all these cases early when the diagnosis of acute appendicitis is still in question. Moreover, should the course of the complaint establish the diagnosis as other than appendicitis, the medication, if judiciously given, will have done no harm. Should the condition prove to be acute appendicitis, the benefits of the drug will be greatly enhanced by early administration. With this therapeutic aid we believe the all too prevalent attitude of when in doubt, operate, may be supplanted by one of, when in doubt, do not operate except under favorable circumstances.

At this point we wish to emphasize the frequency with which seasickness may simulate, in varying degrees, acute appendicitis. Often one sees seasickness associated with malaise, slight elevation of temperature, rapid pulse, altered blood picture, and constipation with vomiting, this associated with or resulting in a soreness and muscle spasm over the area of the cecum and ascending colon. At first the diagnosis may be obscure; however, such cases may be placed on sulfonamide therapy and safely kept under observation for further developments. With fluids, bed rest, and enema the condition usually quickly subsides.

Our incomplete studies even suggest that, except in the most unusual circumstances, chemotherapy might entirely supplant surgery in the treatment of acute appendicitis when operating conditions are unfavorable. We believe a proper and judicious use of this alterna-

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tive by medical officers and hospital corpsmen, especially aboard such small ships as destroyers and submarines, will save lives and eliminate many sick days now incurred through operating under unfavorable conditions. Most cases will promptly clear under this management, but should surgical intervention become advisable, little additional risk to the patient will have been incurred, while maintaining a satisfactory blood concentration of sulfonamide. Such additional risk as is incurred we believe is far outweighed by the great majority of cases that promptly clear without the hazards of operation.

The following case reports were taken from records aboard this vessel.

CASE REPORTS

Case 1.—A ship's cook, second class, age 22 years, was admitted to the sickbay complaining of severe abdominal pain of 3-hour duration, focusing in the right lower quadrant and radiating to the epigastrium and umbilical area. He had experienced some nausea but there was no associated vomiting or bowel disorder. There had been no previous similar attacks.

The patient walked slightly bent forward and lay quietly in bed with his thighs flexed. The abdomen showed muscle rigidity over the right lower quadrant with associated pain on deep pressure and rebound tenderness with greatest intensity just below McBurney's point. Temperature was 99° F., pulse 80, and respiration 18.

Laboratory examination showed urinalysis normal, white blood count 15,000; segmented neutrophils 68 percent, lymphocytes 26 percent, and bands 6 percent.

A diagnosis of acute appendicitis was made. Due to unfavorable conditions at sea, both because of rough weather and of being in a war zone, chemotherapy rather than surgery was decided upon as the preferred method of treatment. Accordingly the patient was placed on sulfanilamide, 2 gm. as the initial dose and 1 gm. four times a day thereafter. During the day the pain localized definitely in the right lower quadrant with rigidity of the overlying right rectus muscle. On the following day, 18 hours later, the pain had subsided and the tenderness and rigidity had greatly decreased. At this time the white blood count was 11,300; segmented neutrophils 56 percent, lymphocytes 38 percent, and bands 2 percent. By the 6th day all signs and symptoms had completely subsided and the patient was returned to duty. One month later, although there had been no further signs of recurrence, the patient was transferred to a United States naval hospital for an interval operation. An appendix showing some evidence of previous inflammation was removed and convalescence was uneventful.

Case 2.—A private, USMC, age 20 years, was admitted to the sickbay complaining of nausea, vomiting, and abdominal pain of 6-hour duration. There was no associated diarrhea or previous constipation. The pain was chiefly in the right lower quadrant and radiated to the lower portion of the epigastrium.

Physical examination revealed a right rectus muscle rigidity and a very definite localized tenderness in the right lower quadrant of the abdomen. No mass was discernible. The temperature was 99.4° F., pulse 84, respiration 20. There were no other objective findings.

Laboratory examination showed white blood count 19,400; segmented neutrophils 67 percent, lymphocytes 23 percent, bands 6 percent, eosinophils 1 per-

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cent, and juveniles 3 percent. Patient was placed on sulfathiazole, 2 gm., as initial dose followed by 1 gm. four times a day as maintenance dosage, fluids by mouth, and bed rest. Within 12 hours the pain and rigidity began to diminish rapidly. On the second day pain and rigidity had subsided, but slight tenderness remained over the appendix area. At this time the white blood count was 7,800; segmented neutrophils 66 percent, lymphocytes 31 percent, and bands 3 percent.

On the third day a slight but localized tenderness persisted but the patient had no other complaints. On the fifth day he was returned to duty.

Case 3.—A seaman, second class, age 23 years, was admitted to the sick list complaining of abdominal pain of 4-hour duration. The pain at onset was cramping in character and located chiefly in the epigastrium but later had gradually shifted to the right lower quadrant. The condition was associated with nausea but no vomiting. He gave a history of similar recurring attacks and chronic constipation for the past 6 months.

Physical examination showed an asthenic type appearing older than his actual age. There was no elevation of temperature or pulse. Abdominal examination revealed definite muscle spasm and tenderness over the region of the appendix on deep palpation, and slight rebound tenderness. The white blood count was 7,400 and showed a differential count of 58 percent segmented neutrophils, 4 percent bands, and 38 percent lymphocytes. The urinalysis was normal.

Under sulfonamide therapy the condition improved but he continued to complain of a deep residual tenderness at McBurney's point and chronic constipation. Upon reaching port 10 days later the patient was transferred to a naval hospital for an interval operation. The appendix was not remarkable in appearance and was removed without difficulty. Upon pathologic study, the gross specimen showed a clear and glistening serosa and when sectioned serially the distal third was found to contain a diminished lumen with a grayish white fibrotic wall. Microscopic examination showed sclerosis of the mucosa and submucosa of this area, and in areas, complete obliteration of the lumen by fibrous tissue and scanty cellular infiltrates of lymphocytes. The pathologic diagnosis was chronic obliterative appendicitis.

This patient's convalescence was uneventful, but upon return to the ship 10 days later he again reported to the sickbay complaining of pain in the right lower quadrant of his abdomen and constipation. A further period of bed rest was ordered. The complete contentment with which he accepted bed rest and the indefinite nature of his complaint soon suggested that he was seeking the sickbay as an escape from a distasteful situation. This belief was confirmed by his own admission under questioning and by reports of his duty shirking. Vigorous measures on the part of the medical department were necessary before he finally became convinced that the sickbay could not be used as a retreat.

Case 4.—A baker, third class, age 23 years, was admitted to the sick list complaining of nausea and vomiting followed by cramping pain across the lower abdomen. The onset of the condition appeared with his reporting aboard ship 24 hours previously. The ship was not under way. There was no evidence of food poisoning or dissipation as an underlying cause. He said that trips aboard small boats always made him seasick. This was to be his first sea voyage.

Physical examination revealed a well-developed stable appearing type of individual. His throat showed an acute pharyngitis. The abdomen was soft but moderately tender across the lower portion. No masses were felt. The patient was obviously ill. The temperature was 99.4° F., pulse 80, respiration 18. Laboratory examination showed the urinalysis normal while the white blood count

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was 11,600; segmented neutrophils 84 percent, bands 6 percent, and lymphocytes 10 percent. Four hours after admission the pain had localized in the right lower quadrant and the white blood count was essentially unchanged. There was considerable loss of fluid through vomiting. The patient was placed on sulfathiazole. Fluid was replenished by repeated intravenous injections of 5 percent dextrose solution in 1,000 cc. amounts. There was considerable improvement both subjectively and objectively on the following day. The vomiting had ceased, the pain had diminished, and the white blood count was 8,200 with a differential count of 82 percent segmented neutrophils, 2 percent bands, and 16 percent lymphocytes. After 5 days the patient's condition appeared normal except for a residual soreness in the right lower quadrant and a slight sulfathiazole drug rash. Although the clinical picture was not quite clear, it seemed advisable to have the appendix removed prior to going to sea. Accordingly he was transferred to a naval hospital.

At operation the cecum and ascending colon were found to be attached to the lateral abdominal wall by slight adhesions, but the appendix was not remarkable and was removed without difficulty.

Pathologic report on the specimen showed grossly a normal appearing appendix. Microscopic examination, however, revealed some fat cells and slight fibrosis in the submucosa.

DISCUSSION

Cases 1 and 2 were probably acute appendicitis and operation could have been done with justification. Case 3 was most likely one in which the underlying condition was a conversion neurosis or perhaps just simple malingering rather than acute appendicitis. Case 4 may have been osme type of acute enteritis or even a psychic form of severe seasickness. Certainly such cases are seen at times in which even the anticipation of a sea voyage brings on the malady.

Chemotherapy has enabled us to treat all these cases conservatively. The early treatment and close observation which medical officers and hospital corpsmen are able to give these patients should render this approach safe. The amount of data presented is admittedly small and incomplete but sufficiently encouraging, we believe, to warrant further study along the same line. This early and incomplete report is presented at this time in the hope it will stimulate further study of the problem.

CONCLUSION

1. The present management of acute appendicitis especially aboard small vessels and isolated shore stations is considered unsatisfactory.
2. Sulfonamide therapy with its resultant elimination of much surgery offers a new and promising approach to the problem.
3. Case reports are insufficient to evaluate properly the relative effectiveness of the different allied drugs but we favor sulfathiazole at the present time.
4. Further data on this subject are necessary before definite conclusions can be drawn, but our studies, though incomplete, indicate that a therapeutic approach to the problem is both logical and effective.

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APPENDICITIS IN THE NAVY

F. GLENN IRWIN
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and
GAINES L. COATES
Lieutenant Commander (MC) U. S. N. R.

The approach to and handling of appendicitis in the Navy varies enough from those aspects of it in civil life to merit discussion. In this presentation we do not hope to add anything new to the voluminous literature on the disease, but rather we hope that this analysis of cases will help, if not the surgeons, at any rate those medical officers who have previously done little surgery.

Of the 300 consecutive appendectomies in our hospital, 34 were chronic and 266 acute, with 11 of the latter found ruptured at operation. All patients admitted to the sick list diagnosed as appendicitis were immediately operated upon unless it could be definitely proved that they had some other disease. We consider this somewhat radical attitude justifiable for the following obvious reasons: Better facilities in hospitals ashore, less loss of time of essential ship personnel, lighter load of responsibility on ships' medical officers.

Two hundred thirty-seven of the 300 appendicitis cases were received from shore stations and 63 from ships. A typical history of appendicitis was given by 183 patients, whereas 117 gave a history considered to be atypical. Twenty-five or 8.3 percent of the total had diarrhea, and 17 had or were recovering from acute catarrhal fever.

The duration of symptoms before operation was as follows:

Duration in hours:	*No. of cases*
Under 6 hours	58
6 to 12 hours	52
12 to 24 hours	77
24 to 48 hours	55
48 to 72 hours	20
Over 72 hours	21
Indefinite	17
Total	300

We consider it significant that such a large number were seen so early and that one-third of the total were seen in the first 12-hour period.

Abdominal findings on physical examination were typical in 213 cases and atypical in 59. An *absence* of positive physical findings was recorded in 28 individuals who at operation were found to have acute appendicitis. It is apparent that a fairly large group of patients re-

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port at sick call with very early appendicitis. These men are usually in excellent, robust health. It has been our not infrequent experience to find newly admitted patients with appendicitis free of pain, asking to be allowed up or wanting to take a shower. Shortly thereafter at operation an acute or gangrenous appendix would be removed.

If morbidity and mortality rates are to be kept low in the service, the Medical Corps personnel should keep in mind factors peculiar to the service. The robust health of the men, their tendency to report very early to the sickbay, the atypical history often obtained, and the atypical or absent physical findings are all points worthy of definite clinical consideration.

Hospital corpsmen on independent duty who are allowed to hold sick call should be thoroughly taught the treacherous aspects of appendicitis. Too often patients with appendicitis give a story of having been given a cathartic for "stomach ache" or constipation. The entire medical department personnel should be constantly alive to the fact that patients with gastro-intestinal complaints require careful observation. The 25 cases with diarrhea and the 17 with catarrhal fever in this series stress the need of careful observation.

The delay in operating on the 41 patients whose symptoms were of more than 48 hours' duration was accounted for as follows:

Cause of delay:	*No. of cases*
Failure of patient to report to medical officer	15
Postponement of operation by ship's medical officer	9
Failure of recognition of the disease by medical officer at shore station	6
Delayed by hospital corpsmen	5
Patients in the brig whose symptoms were unobserved	3
Failure to establish diagnosis by our own staff	2
Operation delayed on submarine	1
Total	41

The 11 patients whose appendices had ruptured were found, as would be expected, in this delayed group. The 9 cases delayed aboard-ship were deliberately delayed with the exception of 2 cases in which early diagnoses were missed. The brig patients frequently had difficulty in convincing the guard that their complaints were genuine. Although "gold-bricking" is an old trick of prisoners, medical officers should be on guard for true pathologic conditions. To cite a specific instance, one such patient had been marched "on the double" a considerable distance to mess hall for 2 days with acute appendicitis. At operation his appendix was gangrenous but fortunately had not ruptured.

The two patients on whom operation was delayed while they were in the hospital, were erroneously diagnosed as having gastro-enteritis. One of these patients gave a history of having eaten at home, and stated that he and his two brothers had developed diarrhea. His ab-

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dominal findings were entirely negative. A ruptured pelvic appendix was removed at operation. A rectal examination might have proved most helpful in arriving at a correct diagnosis in this case, but unfortunately it was not done.

Of the 300 patients operated upon only 2 had refused surgery. One was a minor whose parents gave consent by wire, the other refused on religious grounds but was convinced of the necessity of surgery by his increasing pain.

Spinal anesthesia with procaine hydrochloride alone or in combination with pontocaine was used with the standard preoperative medication of morphine and nembutal in 295 of the 300 operations. Failure with spinal anesthesia was recorded in 8 instances, necessitating supplanting by local infiltration of novocain or by gas-oxygen-ether. Five patients were given general anesthesia. Postoperative nausea and vomiting were minimal following spinal anesthesia. Postspinal headaches were rare. Postoperative catheterization was necessary in only 12 patients. Many were allowed to stand, supported at the bedside, to facilitate voiding. This procedure made no detectable difference in convalescence or wound healing.

Postoperative intravenous fluids were used in 41 patients and the group requiring them coincided with the group in which operation was delayed over 48 hours. Two hundred fifty-nine patients in this series received no postoperative parenteral fluids and their convalescence was uneventful. This again demonstrated the ruggedness of naval personnel. The ruptured cases received large amounts of parenteral fluids.

Various types of suture material were used including cotton. No appreciable difference in wound healing was noted. There were 13 wounds complicated by hematomas, 19 with serum, and 9 were infected, the latter occurring in ruptured cases that had been drained. It is our belief that gentleness in handling tissues, careful hemostasis and the use of small size suture material are the important factors favoring wound healing.

Sulfanilamide or other of the sulfa drugs was administered intraperitoneally and orally to all patients who, in the surgeon's opinion, needed help in combatting their infection. It was used in all gangrenous and ruptured cases, but usually was not administered in early, acutely inflamed cases.

The length of time these patients remained on the sick list was on the average 2 weeks. Patients who were to return to sea duty upon discharge were kept 3 weeks or longer.

There were no deaths in this series of 300 appendectomies. That

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they all recovered,[1] we believe, is due to the postoperative care they received. This was based on Ochsner's principles of morphine every 4 hours, Fowler's position, nothing by mouth, and the use of sulfonamides. Decompression with an indwelling nasal catheter or Miller-Abbott tube and liberal use of parenteral fluids were integral components of the treatment.

The problem of handling acute appendicitis at sea has received wide publicity through the radio and the press as a result of appendectomies having been performed by enlisted personnel. We believe more lives will be lost through surgery performed by unqualified persons than would be lost through a policy of delay of surgery, using proper treatment during the delay period.

The question of operating or delaying operation in cases of appendicitis at sea is determined by many factors. Operating room facilities, equipment, the skill and experience of the medical staff, the weather, condition of alert or nearness to battle are all influencing factors. The smaller the ship the more acute the problem becomes; it is impossible for medical officers to be attached to all ships.

Some patients, transferred to this hospital without having been operated upon at sea, have arrived in excellent condition; others have not. When it is considered that the best course is to delay surgery the following regime is recommended:

1. Strict adherence to Ochsner's principles enumerated above.
2. Decompression of the gastro-intestinal tract from above by use of a Levine or Miller-Abbott nasal tube and Wangensteen type of suction.
3. The liberal use of parenteral fluids.
4. The use of sulfonamides by mouth or intravenously. Sulfa drugs alone are not considered adequate to prevent the spread of infection in the appendix or peritoneum.

Hospital corpsmen should be taught how to pass nasal tubes and rig Wangensteen suction apparatus. This can easily be done on any ship where 2-gallon glass jugs, rubber tubing, and glass or metal tubing are available. Corpsmen should also be adept in administering intravenous fluids. Medical stores of all ships should include Levine nasal tubes and adequate amounts of intravenous fluids.

If the above regime is carried out we feel confident that mortality rates in patients with delayed operation will be low; in fact much lower than in cases subjected to ill-advised and hazardously undertaken surgery.

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[1] Since writing this report 100 additional appendectomies have been done, also with no mortality.

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INTRAVENOUS ADMINISTRATION OF AN ANESTHETIC AGENT[1]

A COMPARISON OF THE TECHNIC FOR ROBUST PATIENTS AND FOR PATIENTS IN SHOCK

JOHN S. LUNDY, M. D.[2]
R. CHARLES ADAMS, M. D., M. S. (ANES.)
and
THOMAS H. SELDON, M. D., M. S. (ANES.)

The intravenous route for the administration of a general anesthetic agent has fascinated medical men with its theoretic excellence for some time. One of us (*1*) has described at length the entire story of the development of this method of anesthesia and the technic of its application. A more condensed description also appears in "Clinical Anesthesia" (*5*) and numerous articles have appeared in the literature (*6*). The relative newness of the use of pentothal sodium as an intravenously administered anesthetic agent made it probable that its widespread use would not be attended with the best results under certain circumstances. Reports concerning untoward results obtained with this method following the Pearl Harbor disaster (*4*) indicated very clearly that something was wrong. It was our opinion that, in cases in which the anesthetic agent was unsatisfactory, especially in the presence of shock, it probably had been administered by the technic usually employed for a robust person. To emphasize the difference in technics a report of a case (*2*) was made, which seemed to emphasize the necessity of modifying the usual technic of administering pentothal sodium intravenously so that it might be safer for the patient in shock. It seems desirable, at this time, to emphasize again cautions that may be utilized in practice to make the intravenous method relatively safe. We shall attempt to illustrate the similarities and dissimilarities of the two methods.

Preoperative preparation. 1. Any patient.—The stomach must be empty; the bladder and the rectum should be empty.

2. Robust patient.—No special precautions other than those given under 1 are necessary.

3. Patient in shock.—In addition to precautions given under 1, parenteral therapy should be started; preferably a 15-gage needle should be introduced into a vein and the administration of blood, plasma, or parenteral fluids should be begun.

Preoperative medication. 1. Average patient.—The patient is given a hypodermic injection of ⅙ grain (0.01 gm.) of morphine sulfate and

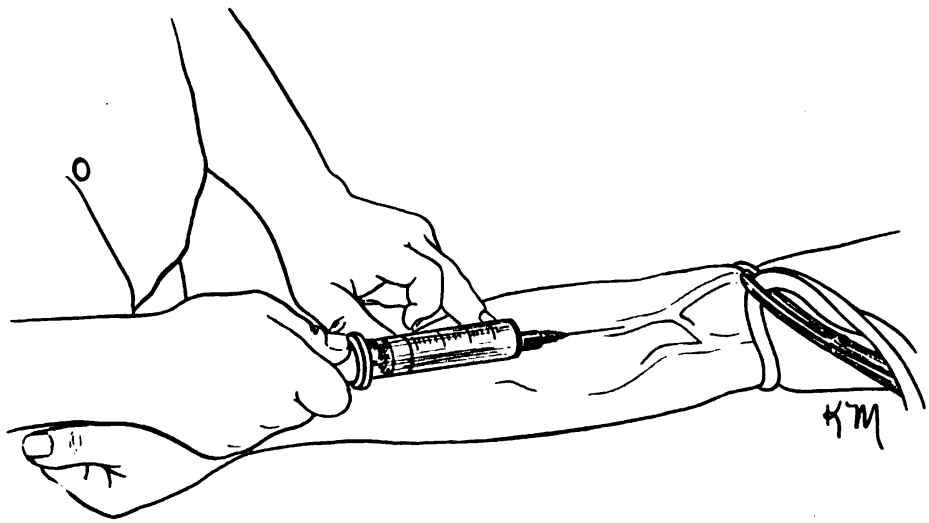
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1/150 grain (0.00043 gm.) of atropine sulfate 40 minutes before administration of the anesthetic agent, or an intravenous administration of those drugs 5 to 10 minutes before administration of the anesthetic agent.

2. Robust patient.—The patient is given a hypodermic injection of ¼ grain (0.016 gm.) of morphine sulfate and 1/150 grain (0.00043 gm.) of atropine sulfate 40 minutes before administration of the anesthetic agent, or an intravenous administration of those drugs 5 to 10 minutes before administration of the anesthetic agent.

3. Patient in shock.—The patient may be given a hypodermic injection of ⅛ grain (0.008 gm.) of morphine sulfate and 1/150 grain (0.00043 gm.) of atropine sulfate 40 minutes before administration of the anesthetic agent, or an intravenous administration of those drugs 5 to 10 minutes before administration of the anesthetic agent. If shock is severe, the preliminary medication is omitted.



1. Tourniquet is above the elbow and close to the site of venipuncture and anchors the vein. The anesthetist stretches the skin overlying the vein and makes suction with the syringe. The patient's hand is clenched in order to keep the vein filled. (Lundy, J. S.: Clinical Anesthesia.)

Venipuncture. 1. Average patient.—A tourniquet is placed within 2 inches (5 cm.) of the site of venipuncture and a 20-gage, short needle with beveled edge is used on a 20 cc. eccentric-type Luer-Lok syringe (fig. 1).

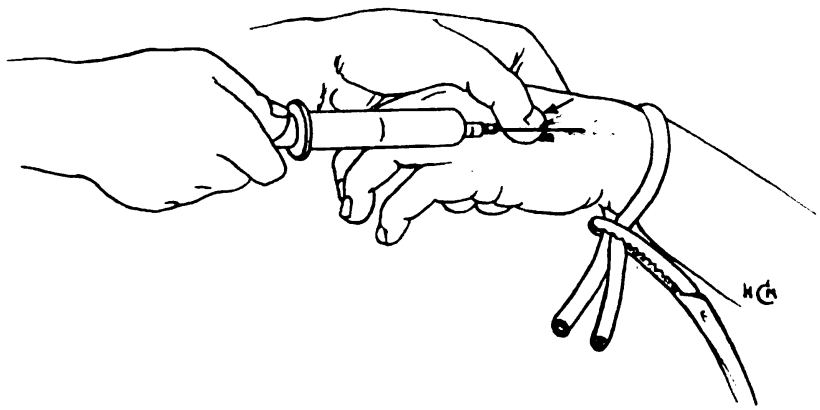
2. Robust patient.—Venipuncture is usually a simple matter, as in 1.

3. Patient in shock.—It may be necessary to search for some time until a suitable vein can be located; fairly frequently it may be found in the back of the hand or the wrist (fig. 2). If shock is very marked and veins are very difficult to find, the application of heat to an extremity usually will dilate the veins sufficiently well that a 20-gage needle can be used satisfactorily. Under extremely difficult circum-

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stances, Anderson's method of venipuncture may be used (*3*). After successful venipuncture, the needle may be strapped to the skin with adhesive and a length of rubber tubing used to connect it to the syringe, or the syringe may be left attached to the needle and held by the anesthetist; certain mechanical devices also may be employed for the operation of the syringe.

Technic of administration. 1. Average patient.—A 2.5 percent solution of the anesthetic agent is used (fig. 3). Sometimes the administration of pentothal sodium should occupy a period of from 5 to 10 minutes before the incision is made, with the idea of gradually injecting the desired dose, which will be sufficient to anesthetize the patient. By this method of slow injection one can introduce a dose that is much larger than could be administered safely in 1 minute. This technic is indicated for major operations. Minor operations requiring



2. Tourniquet is attached close to the site of venipuncture. The anesthetist's left thumb stretches the filled vein (arrow). The needle is inserted into the vein while suction is made with the syringe so that, as soon as venipuncture is accomplished, blood appears in the syringe. (Lundy, J. S.: Clinical Anesthesia.)

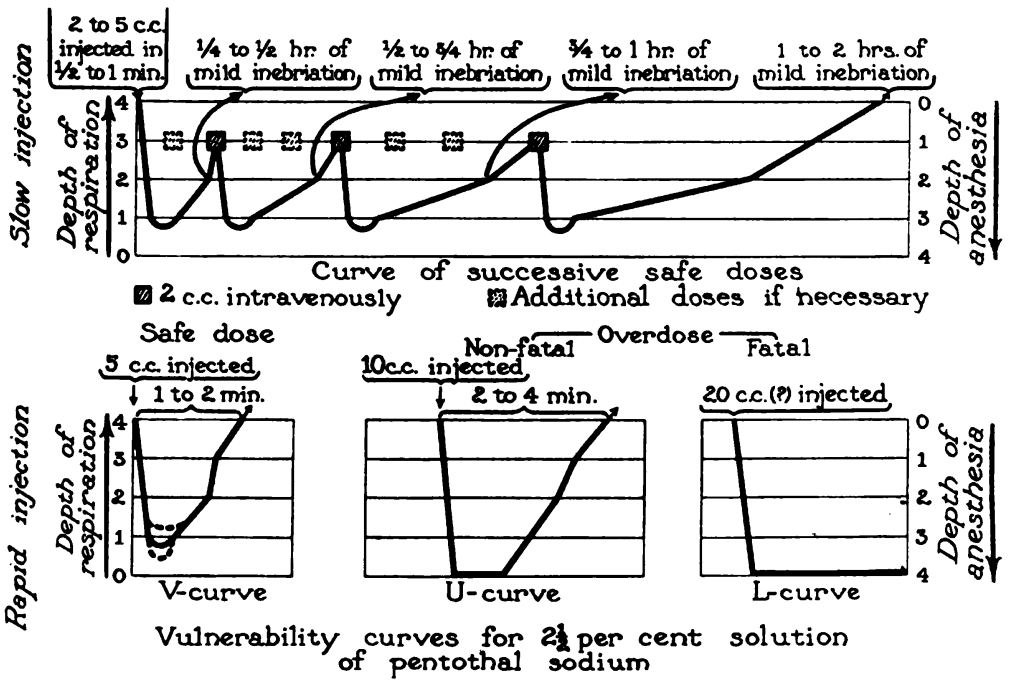
only 1 or 2 minutes of anesthesia can be done by the injection of small doses immediately before the patient is subjected to any painful stimuli. This slow injection of an adequate dose of an anesthetic agent is employed to reduce the total quantity of drug used in the course of an operation of 40 to 60 minutes' duration.

2. Robust patient.—A solution of 2.5 percent but not more than 5 percent may be used. It may be necessary to inject the anesthetic agents until almost the end of the operation.

3. Patient in shock.—One cubic centimeter of a 2.5 percent solution is injected and the patient is asked to count or to hold up a hand; in either case, evidence is sought as to when the anesthetic agent begins to show a definite effect. Ten or fifteen seconds after the first cubic centimeter has been injected, the anesthetist will be able to judge concerning the patient's reaction to that dose of the drug. If the patient's condition is one of great weakness and shock, 1 or 2 cc. may be sufficient

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to cause him to be unable to hold up his hand or to continue counting; however, he may require 3 or 4 cc. before he is relaxed. It is very important that the injection be carried out slowly, as the principal danger for these patients is an overdose. The very cautious administration of a minimal amount of the drug during the operation makes the method relatively safe. One begins the injection just before the operation begins. The incision is made as soon as the patient has reached the surgical stage of anesthesia; thereafter minimal doses are



3. The top lines indicate a slow injection of relatively small quantities of 2.5 percent solution of pentothal sodium. They record the shallowness of respiration when anesthesia is deep and then, as time elapses and more of the drug has been used, usually each dose has a longer and longer effect. This is especially true after from 1 to 1.5 gm. or more has been administered. The bottom lines indicate the rapid injection of a single dose. On the left the curve resembles a V and respiration is not stopped. The center curve, resembling a U, indicates that respiration stops quickly for a short time and then is resumed. The curve on the right resembles an L and indicates a rapid injection of a fatal overdose with quick and permanent paralysis of respiration. Because the three curves look like the letters "V", "U", and "L" the word "vulnerability" was suggested. At the top of this lower part of the figure is indicated the fact that the larger the dose the longer is the period of inebriation after the patient first arouses. (Lundy, J. S.: Clinical Anesthesia.)

injected intermittently as they are needed to control movement of the patient. Occasionally a patient may moan or speak but will not move his body, and subsequently he does not have any recollection of pain. For these patients, very small doses may be employed. In dealing with the shocked patient, the injection of the anesthetic agent may be discontinued before the end of the operation sooner than in dealing with

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the robust patient. The V curve in figure 3 is as deep anesthesia as can safely be used for a patient in shock.

Supplementary measures. 1. Average patient.—The administration of 50 percent nitrous oxide and 50 percent oxygen reduces the quantity of pentothal sodium otherwise necessary; also it provides oxygenation even in the presence of depressed respiration.

2. Robust patient.—Same as for the average patient.

3. Patient in shock.—One hundred percent oxygen probably will be needed. However, the use of 50 percent nitrous oxide and 50 percent oxygen is almost as valuable.

Systemic effects and signs of anesthesia. 1. Average patient.—The lid reflex is absent or sluggish. The eyeball usually is fixed. The pupils are moderately contracted but may react sluggishly to light. Respirations are depressed. Skin reflexes are absent. The masseter muscle is usually relaxed. Abdominal muscles are usually poorly relaxed. Laryngeal reflexes usually are present. The color is pink and the skin is warm and dry. The blood pressure sustains an initial drop of 10 to 20 mm. of mercury but soon approximates the normal level.

2. Robust patient.—Same as for the average patient.

3. Patient in shock.—The lid reflexes are absent. The eyeballs are fixed. The pupils are contracted and fixed. Respirations are depressed.[3] Skin reflexes are absent. The masseter muscle is relaxed. Abdominal muscles probably are fairly relaxed. Laryngeal reflexes are depressed or absent. The color is probably slightly cyanotic and the skin is cold and perhaps moist. The blood pressure usually sustains a more drastic drop than in normal patients with a tendency to remain below the normal level.

Combinations with other agents. 1. Average patient.—Same as for the robust patient.

2. Robust patient.—Since robust patients often require large doses of pentothal sodium to produce surgical anesthesia, combinations with local or regional methods of anesthesia are often of advantage. This reduces the amount of pentothal sodium necessary and permits more extensive operative procedures.

3. Patient in shock.—Because of the lessened tolerance of patients in shock to large doses of pentothal sodium it may be necessary to combine its use with another method. The combination of a local or regional procedure often will be of advantage in dealing with these patients in keeping the amount of pentothal sodium used to an absolute minimum, thereby preventing marked degrees of depression of respiration and blood pressure.

Sulfonamide therapy and intravenous anesthesia. 1. Average patient.—There do not appear to be many contraindications to the use

[3] Respiratory function is very easily depressed, often from very small doses, in patients suffering from shock with or without hemorrhage.

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of intravenous anesthesia for patients undergoing sulfonamide therapy.

2. Robust patient.—Same as for the average patient.

3. Patient in shock.—Patients who are being treated with sulfonamides may be somewhat cyanotic in appearance. This may become especially marked when shock is present. While the administration of oxygen will not clear up this cyanosis effectively, its administration to these patients should be routine if possible. In dealing with a shocked patient who has been given large doses of sulfonamides, extra caution in the administration of pentothal sodium is indicated.

Quinine therapy and malaria. All patients.—Quinine and atabrin therapy should be instituted preoperatively if the patient has a history of having had malaria, with or without previous treatment.

Contraindications. 1. Average patient.—Contraindications consist chiefly of cardiac disease associated with dyspnea.

2. Robust patient.—Contraindications consist of operations about the head and neck or in the mouth or throat where mechanical obstruction of the respiratory passages may occur, in acute intestinal obstruction, and in major operations requiring perfect muscular relaxation.

3. Patient in shock.—Contraindications are the same as for average and for robust patients. However even if none of the contraindications mentioned under 1 or 2 is present, for patients in shock the method probably will be contraindicated unless equipment for maintaining the airway (Magill intratracheal tube) and for administering oxygen is available.

COMMENT

The technics here described are usually satisfactory but they are not the only ones which may be used. However, they do tend to accomplish the essential thing which makes intravenous anesthesia safe, even for the patient in shock, and that is the slow injection of a safe dose.

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THE INCIDENCE OF ACUTE RESPIRATORY INFECTIONS

THE EXPERIENCE OF THE U. S. NAVY SINCE 1881

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Lieutenant Commander (MC) U. S. N. R.

In view of the repeated prophesies of an impending pandemic of influenza which may rival in its severity the pandemics of 1889–90 and 1918–19, it has seemed useful to assemble the figures with regard to the acute respiratory infections occurring in the Navy since 1881. It has not been my expectation that this study would succeed in determining the validity or falsity of the prophecy of a forthcoming influenza pandemic but rather that the study would aid in giving perspective if and when such a pandemic does recur, and would help fit influenza into the general respiratory disease picture.

Because of changes in the diagnostic nomenclature used in the Navy, the same clinical entity has been carried under one heading for a period of years and under an entirely different heading for another period. Graphing of such figures results merely in a series of short curves unrelated to each other and totally incapable of presenting the broad picture of the incidence of a general type of acute respiratory infection. In order to obviate this defect in the basic data (as taken from the Annual Reports of the Surgeon General, U. S. Navy) it has been found useful to compile the figures representing the incidence of acute respiratory diseases under the following general headings: "Acute respiratory infections with little or no fever," "acute respiratory infections with fever and lung consolidation," and "acute respiratory infections with fever but without lung consolidation."

THE ACUTE RESPIRATORY INFECTIONS WITH LITTLE OR NO FEVER.

The acute respiratory infections with little or no fever ("colds" and "sore throats") are of such a mild character that they rarely bring the patient to the medical officer and, more rarely yet, to the sickbay or hospital. To get any idea of the incidence of these "common colds" we are forced to resort to the results of questionnaire studies made in comparable groups. We find that at the usual age levels of Navy personnel an estimated 25 percent of a command (the cold-immune group) will have a cold not more than once a year, another 50 percent of the command (the average group) will have colds two or three times a year, while the remaining 25 percent (the cold-susceptible group) will have colds four or more times a year. With such a dis-

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tribution the incidence of colds in a command of 1,000 personnel can be roughly estimated as follows:

250 of cold-immune group will average ½ cold each, totaling	125
500 of average group will average 2½ colds each, totaling	1,250
250 of cold-susceptible group will average 4½ colds, totaling	1,125
Total	2,500

Of these colds, most will be without constitutional reaction of any severity and without complication of any importance. Consequently, though many of these patients see the medical officer at sick call, comparatively few of them are ill enough to be admitted to the sick list and require an F card. For example, in a typical year there will be a rate of less than 0.2 per 1,000 admissions for acute rhinitis, approximately 3.0 per 1,000 for acute pharyngitis, 2.5 per 1,000 for acute otitis media and 2.0 per 1,000 for acute sinusitis of all types reported.

It would appear from the work of Dochez and others that in these simple colds we are dealing for the most part with mild virus infections which produce comparatively little reaction in the host and are of but little clinical importance, unless bacterial infections superimpose themselves and produce sinusitis, otitis, mastoiditis, or other complications.

THE ACUTE RESPIRATORY INFECTIONS WITH FEVER.

The acute respiratory infections with fever provide a somewhat different picture. They do not occur so often; they tend to produce a fairly complete immunity for 6 months to 1 year or more, a low-grade immunity much longer (*1*); and since they produce a fever and other constitutional symptoms they are more frequently placed under medical care and, therefore, have been much more fully recorded and studied than have colds. It is a well-recognized fact, however, that these infections comprise a complex and heterogeneous group of infections, i. e., secondary bacterial infections superimposed upon simple colds; primary virus infections with influenza virus A, B, or others (*2*); secondary bacterial infections with Hemophilus influenzae, streptococci, staphylococci, or pneumococci, superimposed upon influenza virus infections (*3*); primary bacterial infections with pneumococci of the various types; primary virus infections with one of the several pneumonitis viruses (*4*).

THE ACUTE RESPIRATORY INFECTIONS WITH FEVER AND LUNG CONSOLIDATION.

Under ordinary conditions in the average naval activity through the years, accurate differentiation of the acute respiratory infections with fever into all the known categories has been a practical impossibility. However, the pneumonias and pneumonitis cases have been diagnosed more frequently than have other members of this group, not

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only because their clinical course is more uniform but also because bacteriologic technics, pneumococcus typing, and, most of all, roentgen examinations have provided dependable, differentiating evidence. The recording of these acute pneumonias and pneumonitis cases under the Diagnostic Nomenclature for the Medical Department of the United States Navy has been as follows:

1888–1894—All forms listed under "Pneumonia."
1895–1912—All forms listed under "Febris pneumonica."
1913–1936—"Pneumonia, lobar."
"Pneumonia, broncho."
"Pneumonia, interstitial."
1937–1942—"Pneumonia, lobar."
"Pneumonia, broncho."
"Pneumonia, interstitial."
"Pneumonia, broncho."

The curve of incidence for the acute pneumonias and acute pneumonitis (fig. 1, graph *B*) reveal the following facts:

1. Only twice in the 61 years under analysis did the incidence of acute pneumonia and pneumonitis rise above 12 per 1,000 (14.26 per 1,000 in 1889; 33.24 per 1,000 in 1918).

2. The median rate for acute pneumonia and pneumonitis through the 61 years under analysis was 4.72 per 1,000. The median rate for the 7 years preceding the 1889 peak was 6.40 per 1,000; the median rate for the 28 years between the peaks of 1889 and 1918 was 5.33 per 1,000; the median rate since the 1918 peak has been 2.63 per 1,000.

3. The acute pneumonia and pneumonitis rate for 1942, 7.07 per 1,000, was the highest experienced by the Navy since 1920.

The mortality curve for acute pneumonia and pneumonitis (fig. 1, graph *C*) reveals the following facts:

1. The trend of the death rate has been generally downward for the 61-year period except for peaks which accompanied the 1889–90 and the 1918–20 pandemics of influenza.

2. Since 1936 the downward trend has been markedly accentuated.

The curves of incidence (1913 through 1942) for lobar pneumonia (fig. 2, graph *B*), for bronchopneumonia (fig. 2, graph *C*), and for primary atypical pneumonia (fig. 2, graph *D*) show the following facts:

1. The peak of incidence for lobar pneumonia occurred in 1918; the trend was definitely downward until 1940, when it moved upward again.

2. The peak of incidence for bronchopneumonia occurred in 1918; the trend was irregularly downward from 1918 through 1933, but has been generally upward since 1939.

3. Primary atypical pneumonia cases were first recorded (as acute pneumonitis) in 1937 with a rate of 0.02 per 1,000. The rate for this disease rapidly rose to 0.95 in 1941, and to 2.79 in 1942.

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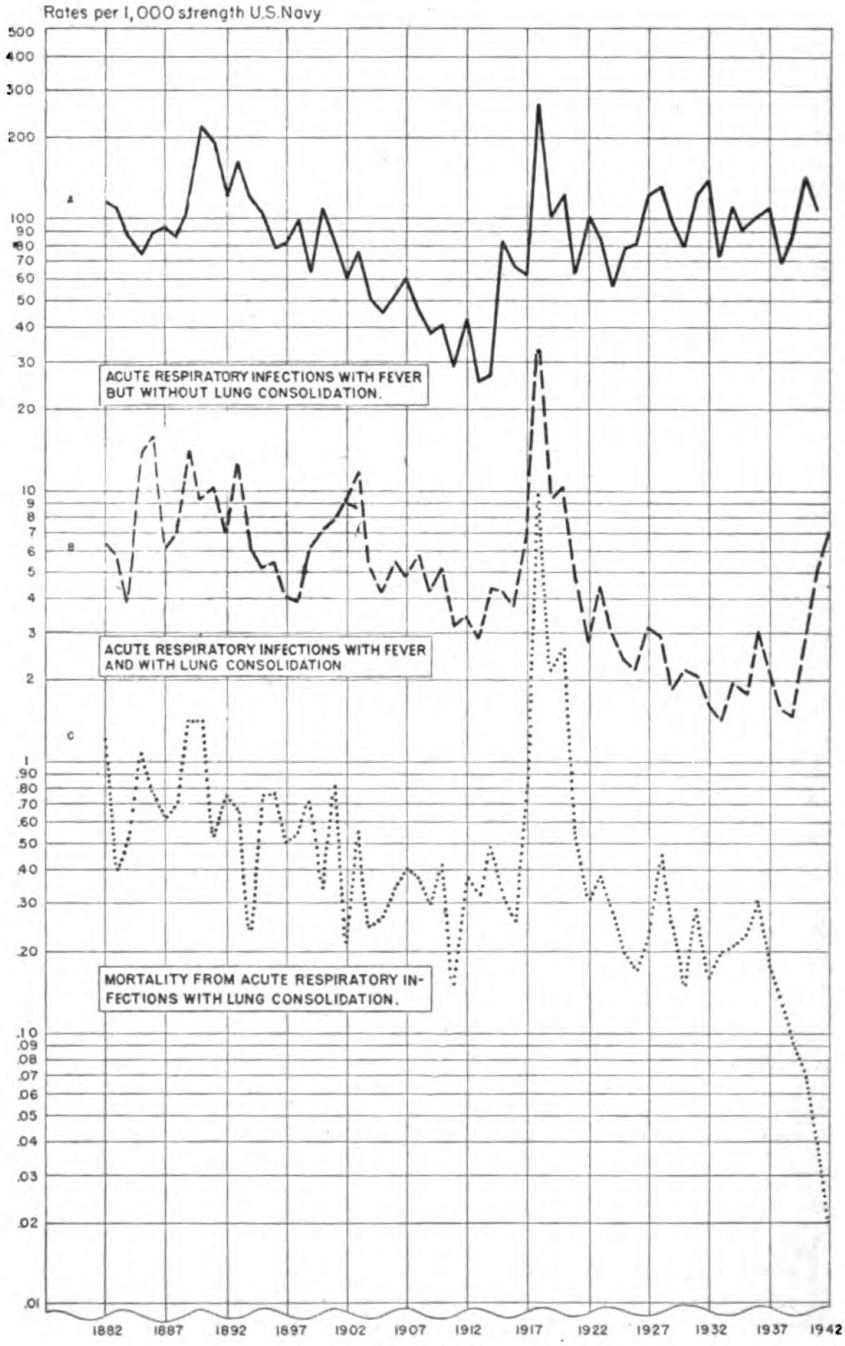


FIGURE 1.

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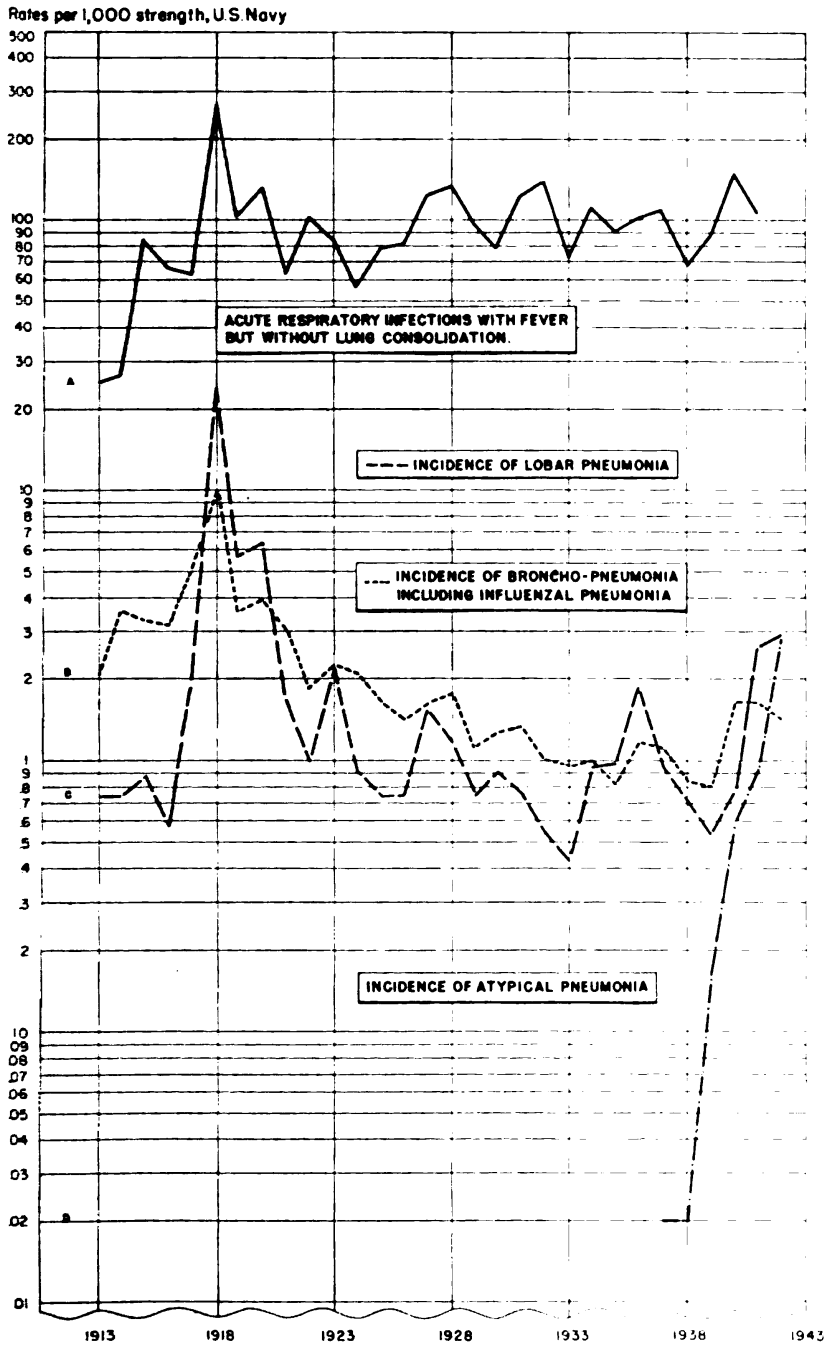


FIGURE 2.

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4. The incidence of primary atypical pneumonia in the U. S. Navy is now greater than the incidence of lobar pneumonia and approximately equal to that of bronchopneumonia.

Charting of the mortality rates (1913 through 1942) for lobar pneumonia (fig. 3, graph *C*) as distinguished from those for bronchopneumonia (fig. 3, graph *D*) reveals the following facts:

1. The peak of the mortality curve for lobar pneumonia was reached

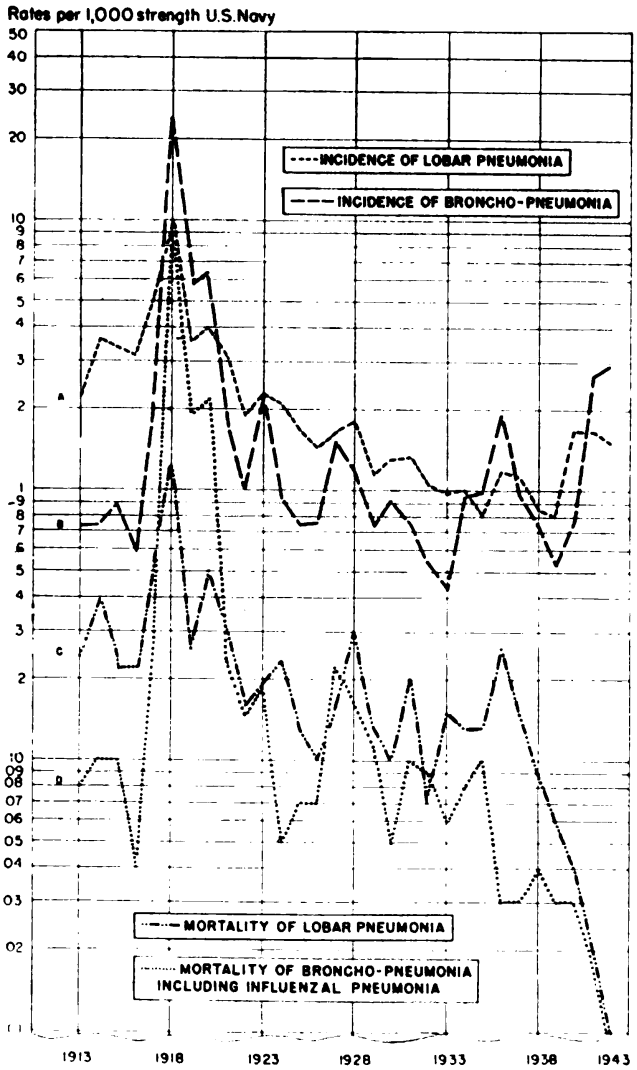


FIGURE 3.

in 1918; the trend was irregularly downward 1918 through 1932; the trend has been sharply downward since 1936 to reach an all-time low in 1942.

2. The peak of the mortality curve for bronchopneumonia was reached in 1918; the trend was irregularly downward 1918 through 1935. The trend has been more sharply downward beginning in 1936 to reach an all-time low in 1942.

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THE ACUTE RESPIRATORY INFECTIONS WITH FEVER BUT WITHOUT LUNG CONSOLIDATION.

The recording of the acute respiratory infections with fever, exclusive of the acute pneumonias and pneumonitis, has been under a variety of different headings. Since differentiation of these cases is not possible clinically or roentgenologically, and has not been practicable bacteriologically, resort has had to be made to the device of the "scrapbasket diagnosis" and the diagnostic titles suffering this indignity have differed from time to time, as the following record shows:

Diagnostic titles receiving the majority of diagnoses of acute respiratory infections with fever, exclusive of pneumonia and acute pneumonitis:

1887–1888—Catarrhus; Febris continua simplex; Bronchitis, acute.
1889–1912—Catarrhus; Catarrhus epidemicus; Bronchitis, acute.
1913–1923—Influenza; Bronchitis, acute; Fever of unknown cause.
1924–1941—Catarrhal fever, acute; Influenza; Bronchitis, acute.

The curve of incidence for the acute respiratory infections with fever, exclusive of acute pneumonia and pneumonitis, for the 60 years (fig. 1, graph *A*) shows the following facts:

1. The incidence has ranged between 25.23 per 1,000 in 1913 and 268.09 per 1,000 in 1918.

2. Only on two occasions in the 60 years under analysis has the incidence of these infections exceeded a rate of 200 per 1,000, i. e., 218.47 per 1,000 in 1890, 268.09 per 1,000 in 1918.

3. Only twice has the rate for these infections dropped below 60 per 1,000, i. e., through the 11-year period 1904 through 1914, and for the single year 1924.

4. The median rate for the acute respiratory infections exclusive of pneumonia and pneumonitis for the 60 years was 86.90 per 1,000 strength; the median rate for the 8 years preceding the 1890 pandemic was 90.85; for the 27 years lying between the pandemics of 1890 and 1918 the median rate was 63.12; for the 23 years since the 1918 pandemic the median rate has been 100.25.

THE USE OF THE TERM "INFLUENZA."

Though the diagnosis of influenza was made in five cases in the Surgeon General's report for 1889 it was not until 1913 that this term became an official title in the U. S. Naval Medical Nomenclature and began to appear consistently in the annual medical reports. The majority of the cases occurring in the "influenza pandemic" of 1889–90, and the "influenza epidemic" of 1893 were reported as "catarrhus epidemicus." The majority of cases in the "influenza pandemic" of 1918–19 and in the "influenza epidemics" of 1920 and of 1922 were reported as "influenza." However, in the more recent "influenza epidemics" of 1927–28, of 1931–32, and of 1940 the majority of cases were reported as "catarrhal fever, acute."

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COMMENTS AND GENERALIZATIONS

From this study it is possible to make certain generalizations regarding the probable future trends of these acute respiratory disease curves. Among these generalizations are the following:

1. If we accept the theory that the majority of our acute respiratory infections with fever but without lung consolidation are caused by the various influenza viruses and that one attack confers a prolonged though only relative immunity against subsequent attack (*5*), then we must conclude that no epidemic of these infections comparable to that of 1918 is immediately imminent, for the reason that since the 1918 outbreak of these infections there has been no let-up in their incidence (the median incidence since the 1918 pandemic has been 100.25 per 1,000 as contrasted with a median of 63.12 for the 27 years preceding the 1918 pandemic, and a median of 90.85 for the 8 years preceding the 1890 pandemic).

2. Even if an influenza pandemic as widespread as that of 1918 should occur the death rate should not be seriously raised if we effectively apply our new-found sulfonamide drugs. Influenza, per se kills very few people. The bronchopneumonia that superimposed itself on the influenza and killed 4,158 naval personnel in 1918, should find little opportunity to produce such lethal effects in an influenza epidemic of 1943, 1944, or thereafter. In support of this statement is the 1942 naval experience with the bronchopneumonia incidence at the highest point in 22 years and the bronchopneumonia mortality at an all-time low.

3. The disturbing factor amongst the acute respiratory infections that gives us real reason for worry is the atypical pneumonia (acute pneumonitis). Starting with only 2 cases in the year 1937, a rate of 0.02 per 1,000, this infection has increased rapidly to a rate of 2.7 per 1,000 in 1942. From a point at the bottom of the chart this disease in 6 years has spiraled to a point above that of lobar pneumonia and almost equal to that of bronchopneumonia. Fortunately to date this has been a benign form of pneumonia and no deaths among all these cases have been recorded. We must, however, definitely face disagreeable facts:

(a) Atypical pneumonia is becoming a progressively more serious disease each year (atypical pneumonia deaths among Navy personnel have already been recorded in 1943).

(b) Of the three forms of pneumonia—lobar, broncho- and atypical—the atypical pneumonia is the only one which consistently fails to respond to sulfonamide therapy.

(c) We have no generally acceptable form of specific therapy for atypical pneumonia.

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(d) Atypical pneumonia is considerably more communicable than is lobar or bronchopneumonia and may assume definite epidemic proportions in camps (*6*), barracks, schools, etc.

CONCLUSIONS

1. The average incidence of acute respiratory infection without fever (common cold) among U. S. Navy personnel is estimated at approximately 2,500 cases per 1,000 per year.

2. Through the 61-year period, 1882 through 1942, the incidence of the acute respiratory infections with fever and evidence of consolidation (pneumonia and pneumonitis) has exhibited the following characteristics:

(a) A median rate of 4.72 per 1,000 strength per year.

(b) Major peaks in 1889 and 1918.

(c) Minor peaks in 1903 and 1942.

(d) A much lower median rate in the period since 1918 than in the period lying between the pandemics of 1889–90 and of 1918.

3. Through the 60-year period, 1882 through 1941, the incidence of the acute respiratory infections with fever but without evidence of consolidation (influenza and "grippe") has exhibited the following characteristics:

(a) A median rate of 86.90 per 1,000 strength per year.

(b) Major epidemic peaks in 1890 and 1918.

(c) Minor epidemic peaks in 1893, 1920, 1922, 1927–28, 1931–32, 1940.

(d) A much higher median rate in the period since 1918 than in the period between 1890 and 1918 or the 8-year period preceding 1890.

4. In the 6 years elapsing since the diagnosis "acute pneumonitis" was added to the Diagnostic Nomenclature for the Medical Department of the U. S. Navy the incidence of this disease has risen from .02 per 1,000 to 2.79 per 1,000 strength, but this rise has been unaccompanied by any deaths up to and through 1942.

5. The death rate for lobar pneumonia and for bronchopneumonia reached its peak in 1918 and the trend has been irregularly downward with precipitous drops in the rates beginning for lobar pneumonia in 1937 and for bronchopneumonia in 1936.

6. From the above data, and for other reasons as given, it is concluded that the immediate threat of the acute respiratory diseases lies not so much in an impending influenza epidemic as in the further extension and increased virulence of primary atypical pneumonia (acute pneumonitis).

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POLIOCIDAL ACTION OF OZONE

Demonstration that certain strains of poliomyelitis virus are refractory to concentrations of chlorine used in routine water purification has led to the study of the possible poliocidal efficiency of ozone, which has long been known to be effective against certain other resistant micro-organisms (e. g., Endameba histolytica cysts). Two strains of poliomyelitis virus were diluted with saline solution and subjected to parallel sterilization tests with chlorine and ozone. At stated intervals measured samples of each mixture were treated with identical amounts of sodium thiosulphate and immediately injected intracerebrally into monkeys, the inoculation tests usually being made in triplicate. The resultant fatalities showed that poliomyelitis virus is inactivated "almost immediately" (within 2 minutes) by ozone, while nearly 3 hours were usually required for similar inactivation with chlorine. Ozone, thus, is far superior to chlorine as a virucidal agent which "warrants additional experimentation."—Manwaring, W. H.: Editorial. California & West. Med. 59: 111, August 1943.

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CONTROLLED PROTEIN THERAPY FOR BURNS

The fluid which fills the vesicles of a burn is not whole plasma, but contains mainly albumin. The average content of the vesicle fluid has been found to be: Total protein, 3 to 4.5 gm. percent, of which albumin constitutes 80 percent or more.—Mahoney, E. B., and Howland, J. W.: Treatment of the severely burned patient with special reference to controlled protein therapy. New York State J. Med. 43: 1307–1315, July 15, 1943.

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THE DIAGNOSIS OF INFLUENZA AND CATARRHAL FEVER, ACUTE

A PLEA FOR ACCURATE DIAGNOSIS

THE PERSONNEL[1]
of
Naval Laboratory Research Unit No. 1
University of California
Berkeley, Calif.

In civilian medical practice, as well as among the laity, there has been a tendency since the 1918–19 influenza epidemic to use carelessly the diagnostic designation "influenza." A wide variety of febrile respiratory conditions and even many vague gastro-intestinal disorders are erroneously termed "the flu." In order to counteract this tendency in the Medical Department, about 20 years ago the Navy introduced into its medical terminology the designation "catarrhal fever, acute" for all forms of influenza-like respiratory conditions. However catarrhal fever has come to serve as an even more inclusive "catch-all" diagnosis than the term which it was meant to replace.

During the period from December 1942 to May 1943 the medical officers of Laboratory Research Unit No. 1 had occasion to observe several hundred patients with a diagnosis of catarrhal fever, acute, at a large west coast naval dispensary. It was found that all of these cases could have been given a more specific designation. Included under this diagnosis were found cases of influenza, atypical pneumonia, lobar pneumonia, septic sore throat, acute follicular tonsillitis, acute laryngotracheitis, acute bronchitis, rubella, and common cold, this latter of both afebrile and febrile types. Of all these conditions the only cases justifying the nonspecific designation of catarrhal fever were the cases of common cold with fever—the "febrile catarrh" of the English writers.

There are many obvious disadvantages to the grouping of such a wide variety of diseases under one heading. Both diagnostic and therapeutic carelessness result. It is not uncommon to find the statement "catarrhal fever routine" on the treatment sheet of such widely varying conditions as acute bronchitis, rubella, and streptococcic

[1] The Unit Personnel consists of: Capt. A. P. Krueger, Medical Corps, Officer-in-Charge; Lt. H. W. Bischoff, Medical Corps; Lt. A. S. Browne, H–V (S); Lt. O. J. Golub, H–V (S); Lt. A. H. Jacobs, Medical Corps; Lt. J. R. Mathews, H–V (S); Lt. L. E. Rosenberg, H–V (S); Lt. N. S. West, H–V (S); Lt. (jg), M. D. Thaxter, Hospital Corps; Lt. (jg) H. M. S. Watkins, H–V (S); Ens. A. J. Glazko, H–V (S); Ens. G. B. Saviers, Hospital Corps; Pharmacist I. L. Shechmeister, Hospital Corps; Chief Pharmacist's Mate W. L. Axelrod; Pharmacist's Mate, first class, E. R. Chisholm; Pharmacist's Mate, first class, C. R. Webb, Jr.; Pharmacist's Mate, first class, H. R. Burkhead; Pharmacist's Mate, first class, W. D. Won, all of the United States Naval Reserve.

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sore throat. Another disadvantage of great importance is the resulting statistical errors. The Bureau of Medicine and Surgery maintains an excellent statistical department which is of great value from a public health viewpoint. However, the statistical data on the respiratory disorders, especially on such potentially dangerous epidemic diseases as influenza and atypical virus pneumonia, are erroneous when these are reported as catarrhal fever.

Laboratory Research Unit No. 1 is especially interested in this problem as it affects the diagnosis of influenza, both from an epidemiologic and from an experimental aspect. For example, this unit in 1941 vaccinated with influenza vaccine 9,155 men, with 10,432 others serving as controls. It was hoped that a clear-cut evaluation of the efficacy of this vaccine might be obtained by comparing the incidence rates for influenza in these two groups. However the onset of war made it impossible to carry out the original comparative study and no final proof of the value of the immunizing agent accrued. In the course of this investigation one gained the impression that even had there been no war the results of the project would have been seriously jeopardized by the inaccuracies of reporting.

Study of incidence charts of influenza, were this disease accurately reported to the Bureau of Medicine and Surgery, would enable the Navy to note early increasing incidence of the infection before it reached epidemic proportions and thereby permit the early application of the various methods which have been developed to retard the spread of this dread epidemic.

An attempt was made to determine why medical officers of the Reserve so rapidly fall into the "catarrhal fever" habit. Many officers were questioned about the diagnosis of catarrhal fever and the various respiratory disorders which have been placed in this category. It was found that two factors were mainly responsible for this practice. To a busy medical officer with a large ward, the use of the general term "catarrhal fever" serves as a time and labor saving device. Even more important in the case of failure to diagnose influenza is the administrative objection to the extra paper work associated with the reporting of influenza.

Cases of true epidemic influenza are occurring in the Navy in the area in which our laboratory is located. Whether similar cases are appearing in other sections of the country and whether they are on the increase cannot be determined because of the unreliable reporting of influenza.

During a 2-week period in January 1943, at which time the incidence of respiratory infections in this part of the country was high, 5 patients whose clinical pictures were those of influenza were admitted to the wards of a naval dispensary with the diagnosis of catarrhal fever. These 5 cases are briefly summarized in charts 1 to 5. Rhino-

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pharyngeal washings were obtained from all 5 of these men and in each instance a type A influenza virus was isolated. The details of the laboratory isolation of the virus from these cases and the use of one of these strains for production of clinical influenza in human volunteers will be described elsewhere.[2]

Influenza is not merely nosologically distinct from other respiratory infections but is due to a specific etiologic agent, the influenza virus. This virus cannot be isolated from any of the other "catarrhal fever" group of respiratory diseases. The accuracy of the diagnosis of influenza can, therefore, be put to the test of virus isolation.

During an epidemic the clinical diagnosis of epidemic influenza can be made with ease. Sporadic cases, however, cause some difficulty, being confused especially with the febrile type of common cold (acute catarrhal fever or febrile catarrh) and with streptococcic tonsillitis (septic sore throat). Nevertheless, the diagnosis can be made in most instances with a fair degree of accuracy if the characteristic clinical picture of influenza is kept in mind. The onset is sudden without premonitory symptoms. The first symptoms are general, consisting of chills, headache, malaise, and muscular pains.

Later, respiratory signs may develop with mild coryza, epistaxis, very mild sore throat, and a dry, unproductive, short cough. The patient may complain of a feeling of tightness in the chest. The temperature rises rapidly and is usually spiking in character with daily spikes for 3 to 4 days, after which it remains normal unless complications occur. A diphasic type of temperature curve may occur. The constitutional symptoms continue to dominate the picture throughout. Physical signs are slight or absent in spite of the fact that the patient appears to be and feels quite ill. The typical facies in a severe case is heavy and drowsy with drooping eyelids, glistening eyes, dusky facial flush and slightly cyanosed lips. The tongue may be furred; the voice is husky but not hoarse. There is usually a pharyngitis limited to the posterior pharyngeal wall and characterized by large-vessel injection, a tendency to dryness, a red granular appearance, no exudate and very little subjective throat soreness. There may be a few rhonchi or râles at the bases toward the end of the fever.

The so-called "spine sign" characterized by stiffness of the spine is a frequent result of the severe muscular pains in the large muscle masses of the back. The commonest chest complication is a characteristic bronchiolitis. On the whole, cases are remarkably uniform in clinical appearance and there is no tendency to admixture with other diseases such as tonsillitis. The most important variations from the typical cases are those with chest complications. The blood count in influenza will be discussed below.

[2] U. S. Naval Laboratory Research Unit No. 1: Experimental human influenza. Am. J. M. Sc. In press.

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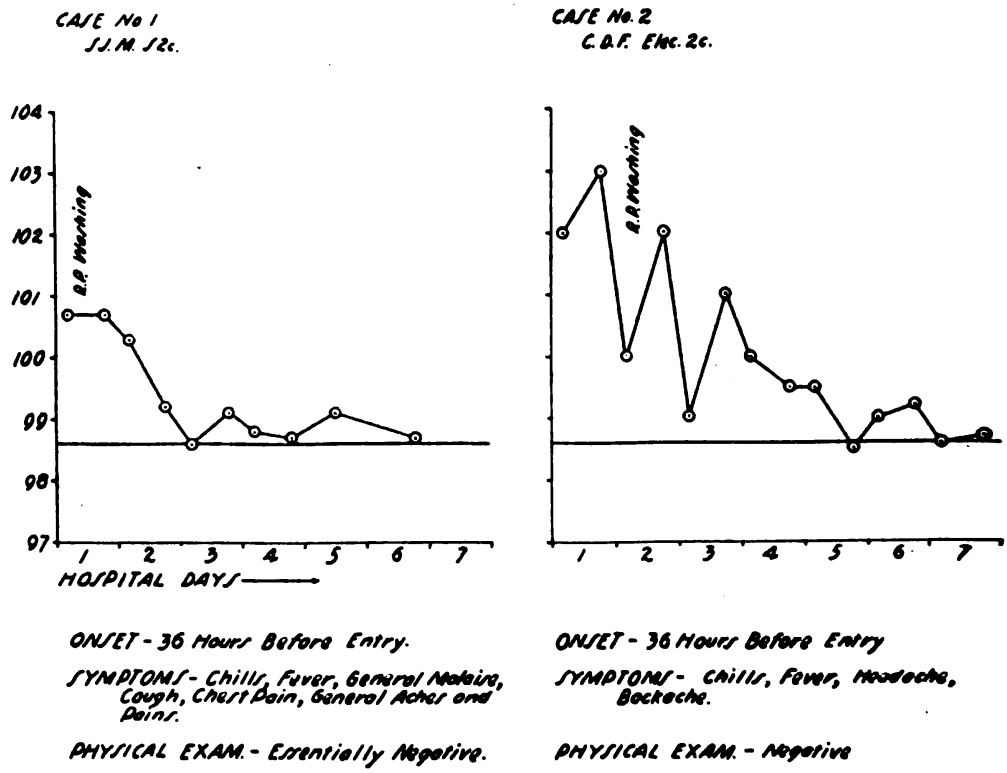


FIGURE 1.

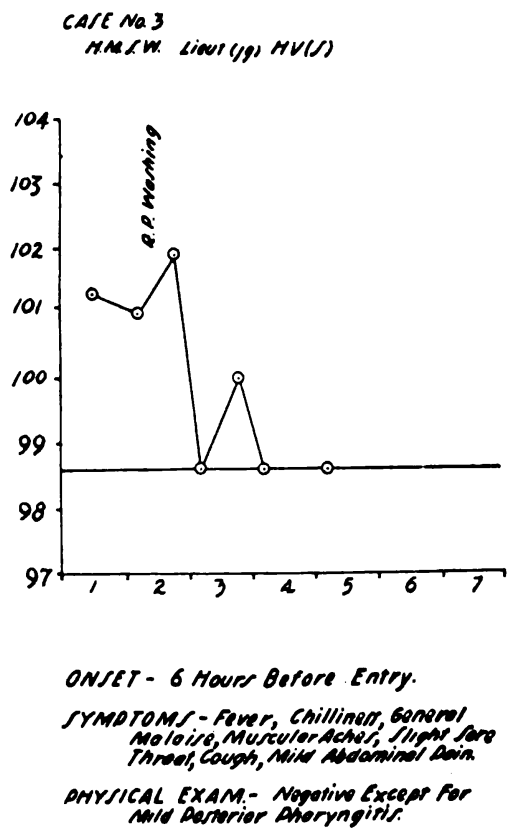


FIGURE 2.

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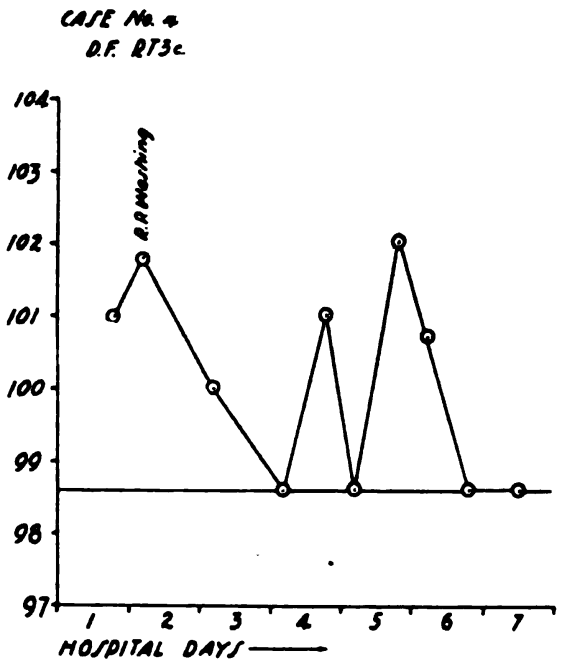


FIGURE 3.

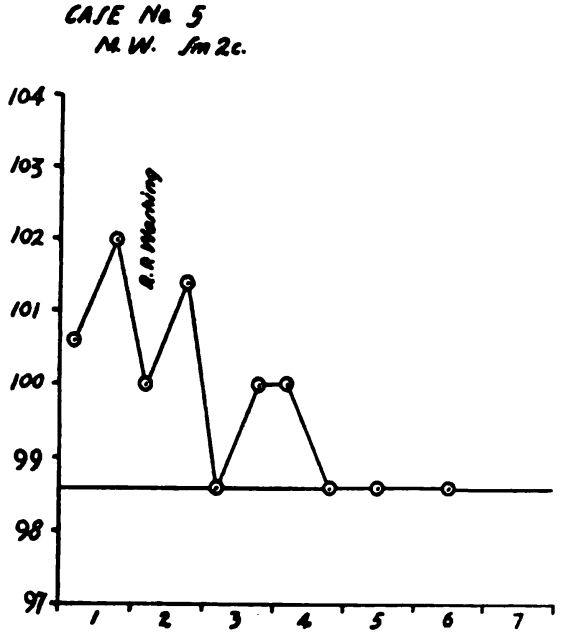


FIGURE 4.

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In contrast to the uniform picture of epidemic influenza, the febrile catarrhs exhibit a more variable course. The onset is usually insidious with a premonitory "cold" and cough for several days. Respiratory symptoms usher in the disease, and sore throat and cough dominate the picture. The cough is usually paroxysmal and productive with substernal soreness over the trachea. Hoarseness of the voice frequently develops. The constitutional symptoms, although present are overshadowed by these respiratory symptoms. The fever has no characteristic course. The patient presents the appearance of having a "heavy cold." The nose is obstructed and there is both a tonsillitis and pharyngitis, with intense capillary injection and exudation of mucus, mucopurulent or follicular material. The clinical picture varies greatly from a predominating coryza to a tonsillitis, laryngotracheitis or acute bronchitis.

Septic sore throat may also be confused with influenza because of the sudden onset with chill, malaise and muscular pains. However the severe soreness of the throat and the marked tonsillar involvement and exudate should disclose the nature of the condition. These differential diagnostic points are presented more graphically in table 1.

TABLE 1.—*Differential diagnostic points*

	Influenza	Catarrhal fever	Septic sore throat
Onset	Sudden	Insidious	Sudden.
Symptoms	Constitutional symptoms predominate.	Respiratory symptoms predominate.	Marked constitutional symptoms plus severe sore throat.
Cough	Short and dry	Paroxysmal, irritating, painful and often productive.	Usually absent.
Epistaxis	Frequent	Infrequent	Infrequent.
Pharynx	Posterior pharyngitis with no exudate and little soreness.	Pharyngitis plus tonsillitis with exudate and soreness.	Swollen, inflamed tonsils with sloughing white exudate; marked soreness.
Fever	Sometimes diphasic	Rarely diphasic	Rarely diphasic.
Contacts	Clinical picture uniform although graded in severity.	Clinical picture variable	Clinical picture uniform.
Leukocyte count	Not diagnostic but usually no leukocytosis in uncomplicated cases.	Not diagnostic	Leukocytosis.
Isolation of etiological agent.	Influenza virus from rhinopharynx.	None	Hemolytic streptococci from throat swabs.
Serological	Rise in antibody titer to specific virus.	None	Not necessary for diagnosis.

It has been the custom to lean heavily upon the white blood count in the differential diagnosis of influenza. A marked leukopenia is usually considered a necessary feature of the disease. However a review of the literature describing the various influenza epidemics of this century reveals that leukopenia is an inconstant accompaniment of the disease. The vast majority of white blood counts have fallen within the 3,000 to 14,000 limits given as the normal limits of white blood counts by Price Jones. The average white count in most epi-

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demics has been about 7,000. Rather than a leukopenia, an absence of leukocytosis seems to be a characteristic of influenza, but even this may be misleading in the differential diagnosis since many cases of proved influenza during epidemics show a leukocytosis, especially when there are complications or foci of pyogenic infection.

In conclusion, it should be pointed out that from an epidemiological point of view, an epidemic of influenza is imminent in the near future. Epidemics of influenza characteristically reach their peaks rapidly so that only accurate diagnosis and correct reporting of sporadic cases will give the information necessary to spot an approaching epidemic in time to institute measures to prevent the spread of the disease and to mitigate the serious effects of such an epidemic on a fighting force. Mild sporadic influenza can be correctly diagnosed as is evidenced by our experience with mild cases diagnosed clinically and proved by isolation of influenza A virus.

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SALINE IN SHOCK

The early use of physiologic saline solution for the maintenance of blood volume in an attempt to prevent early deaths from shock was frequently resorted to in the past but has now been almost completely abandoned. It is even considered by many workers to be dangerous. A recent report indicating that saline solution when properly used may be superior to plasma is, therefore, of considerable interest and may result in a revision of some of the current concepts on this subject.

Sodium chloride given by mouth or intraperitoneally caused a significant reduction in the mortality. Intravenous administration was less effective, and an isotonic solution given by mouth was superior to hypertonic solutions. Potassium chloride, on the other hand, caused acceleration in the time of death, and when administered together with sodium chloride, it seemed to antagonize the effects of the latter. Calcium gluconate given orally was without effect. An isotonic glucose solution given by mouth showed only slight therapeutic action, whereas the administration of hypertonic glucose solutions or of water by mouth caused the animals to die sooner than the controls. A number of other sodium salts, including the acetate, succinate, bicarbonate and lactate, were found to be just as effective as sodium chloride. Of particular interest is the finding that mouse serum given intravenously was somewhat less active than equivalent volumes of physiologic saline solution given orally. Little effect was observed from the intravenous administration of hypertonic human serum albumin.—Editorial. Prevention of shock in burns. New England J. Med. 229: 302–303, August 12, 1943.

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WARTIME FRACTURES IN THE NAVY

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A statistical study of all patients admitted to a continental naval hospital with the diagnosis of fracture has been made in an attempt to evaluate the fractures seen under wartime conditions. This study covers approximately a 15-month period. Rib, skull, and facial bone fractures have not been included.

TABLE 1.—*Distribution of lesions*

Number of patients	157
Number of fractures:	
Fresh	79
Old	157
	236
Type of fracture:	
Compound	91
Simple	145
	236
Bones fractured:	
Tibia and fibula	54
Tibia alone	12
Fibula alone	4
Vertebra	25
Femur	24
Radius and ulna	18
Radius alone	6
Ulna alone	5
Calcaneus	17
Tarsal bones (exclusive of calcaneus)	16
Humerus	12
Metacarpal	10
Pelvis	7
Metatarsal	6
Carpal navicular	6
Carpal bones (exclusive of navicular)	4
Clavicle	4
Phalanx	4
Patella	2
Total fractures	236

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There were 236 fractures in 157 patients. Any fracture incurred less than 21 days before admission was termed fresh. There was a relatively large number of compound fractures. It is interesting to note the high incidence of lower extremity fractures (table 1).

TABLE 2.—*Causation*

War injuries (shrapnel, explosions, bullets)	53
Vehicles (auto, 36; motorcycle, 6; tractor, 1; rollercoaster, 1)	47
Falls	44
Miscellaneous	13
Total patients	157

This hospital is located adjacent to a metropolitan area. It receives its patients from ships, from other hospitals by transfer, and from nearby Navy and Marine Corps activities. It is of interest that approximately one-third are direct war injuries, one-third are due to vehicle accidents (automobiles seem to be effective "fifth columnists"), and one-third are due to falls to one type or another (table 2).

TABLE 3.—*Treatment*

Average number of days of treatment prior to entry to this hospital	76.2
Treatment prior to entry to this hospital:	
External fixation (casts, splints, pins)	107
None	32
Internal fixation (plates, screws)	15
Arthrodesis	2
Arthroplasty	1
Debridement (exact number not known)	
Total patients	157
Treatment at this hospital:	
Nonoperative:	
Physiotherapy	50
Casts, splints, and physiotherapy	46
Skeletal traction	4
Total patients	100
Operative (57 patients):	
Bone grafts (nonunion)	13
Skin plastics (grafts, scar excisions)	10
Open reductions	9
Arthrodesis	9
Pin fixation	6
Closed reduction	4
Sequestrectomy	4

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TABLE 3.—*Treatment*—Continued

Operative (57 patients)—Continued.	
Drilling (delayed union)	4
Debridement alone	3
Manipulations	2
Osteotomy	2
Amputations (toes)	2
Incision and drainage abscess	1
Excision patella	1
Total operations	70

The majority of patients had received at least first-aid treatment before entry into this hospital. Cast fixation was employed most commonly, and this, except in femur fractures, was usually without pins (table 3).

TABLE 4.—*Disposition*

Average total days on sick list (all hospitals)	198.5
Ultimate disposition:	
Full duty	80
Under treatment	29
Discharge from service	23
Limited duty	18
Transfer to other hospitals	7
	157

The average total number of days on the sick list following fracture is just over 6 months. This relatively long period of time is due to two factors. First of all, there were many compound fractures due to shrapnel with their resulting high incidence of complications. Secondly, the injured man must remain on the sick list until he is finally disposed of—either returned to full duty, surveyed to limited duty, or invalided from the service. If a man is returned to full duty he must be in perfect physical condition, and the period of "conditioning" is sometimes quite long after the fracture itself has healed. If other disposition is made, the time from medical survey until the man is discharged from the hospital consumes several weeks, these days counting as days on the sick list.

It should be emphasized that the aim of every medical officer should be to return the individual to full duty. In recent months, however, there has been a trend toward returning convalescing patients to limited duty. There has also been a tendency to send those patients to limited duty, who before the war would have been invalided (table 4).

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TABLE 5.—*Complications*

Nerve palsy	14
Nonunion	12
Lack of full joint motion	11
Traumatic arthritis	10
Delayed union	9
Ulcer	8
Pain	8
Malunion	6
Osteomyelitis	5
Tendon disruption	2
	85

The complications encountered in this series are not particularly noteworthy. There was a relatively high incidence of nerve palsy because of the number of shrapnel and bullet injuries. There was comparatively little osteomyelitis in those compound fractures resulting from war wounds. It is our belief that cast treatment, with infrequent changes of dressings, accounts for this low incidence of infection. Sulfanilamide was most often used locally, and in some cases one of the sulfonamides was administered orally. Many cases had no debridement, others very superficial cleansing, and in others real debridement under anesthesia was carried out; these latter cases were rare. Of necessity the amount of debridement is not accurately recorded in the health records. Too much praise cannot be given the medical officers and corpsmen who first handled these cases; the immediate care, we feel, is a very important factor in the ultimate good results obtained.

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GALLBLADDER SURGERY IN DIABETES

The result of surgical treatment of gallbladder disease in the patient with diabetes is equally as good as in the patient without diabetes.

The eradication of a diseased gallbladder will neither heal nor lessen the severity of diabetes, as measured by the insulin requirement 1 year before, as compared with 1 year after operation.

The incidence of complications in benign gallbladder disease is considerably greater in the diabetic than in the nondiabetic. Twenty-two percent of the benign gallbladder lesions came to operation with complications which included hydrops, empyema, gangrene, perforation and pancreatitis.—Eisele, H. E.: Results of gallbladder surgery in diabetes mellitus. Ann. Surg. 118: 107–115, July 1943.

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FRACTURES OF THE CARPAL SCAPHOID

A STUDY OF 10 CASES

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Lieutenant Commander (MC) U. S. N.

Cave (*1*) lists the incidence of fractures of the carpal bones in civil life as about 2 percent of all fractures. It is our impression that navicular fractures occur much oftener in the naval service than in civil life. One contributing factor is undoubtedly that of age. Several writers have found the ages of greatest prevalence to be 15 to 35 years (*1*) (*2*) (*3*). Another factor is that of sex; Soto-Hall and Haldeman (*2*) have shown that in any series of scaphoid fractures there is a marked preponderance of males, sometimes as high as 94 percent. In the Navy the types of duty and of vigorous recreation are such that personnel are more prone to sustain the kind of fall which might fracture the scaphoid. In civil life the most common wrist fracture observed is Colles' fracture; in naval medical practice generally, the most common fracture of the wrist observed is that of the scaphoid bone.

By prompt recognition of the fracture and immediate treatment, personnel may be returned to their wartime duties with minimum partial disability and ultimately restored to complete usefulness with normal wrist function. Most authors agree that prompt immobilization of such fractures leads to complete restoration of wrist function in practically all cases.

The tragedy of a chronically weak, painful wrist can usually be blamed upon a hasty, inadequate examination without benefit of x-ray visualization at the time of primary injury. We have concluded that the diagnosis of sprained wrist should never be made unless x-ray findings have shown no evidence of fracture. The following cases illustrate this point.

CASE REPORTS

Case 1.—A seaman, second class, USN, 18 years of age, while boxing with heavy gloves struck his opponent's gloved hand with his right hand as his opponent simultaneously struck outward. The right hand was forcibly extended. He received local treatment for a painful wrist, and the wrist was taped but no x-ray was taken.

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He appeared at this dispensary 2 months later for fulguration of a wart and incidentally complained of pain in the right wrist. X-ray (fig. 1) revealed an ununited fracture with displacement of the distal fragment, causing narrowing of the radiocarpal joint and limitation of wrist motion. The right wrist showed 15° less extension and flexion than the left wrist and 5° less radial flexion. On forced extension and flexion of the wrist there was extreme pain and slight pain on forced ulnar and radial deviation. There was moderate pain on pressure over the snuff box. Grips were equal and strong, right and left hands.

Inasmuch as pain was thought to be due to nonunion rather than to poor position, a cast was applied to include the entire abducted thumb and hyperextended hand to the metacarpophalangeal joints, with the wrist flexed in a radial direction. After 8 weeks there was good, though incomplete, bony union and another cast was applied and maintained for 4 weeks.



1. Case 1.—The film, taken 2 months after injury, shows a fracture through the proximal third of the carpal scaphoid. There has been absorption of bone along the fracture line. The fragments are loose and in malposition, accounting for limitation of joint motion.

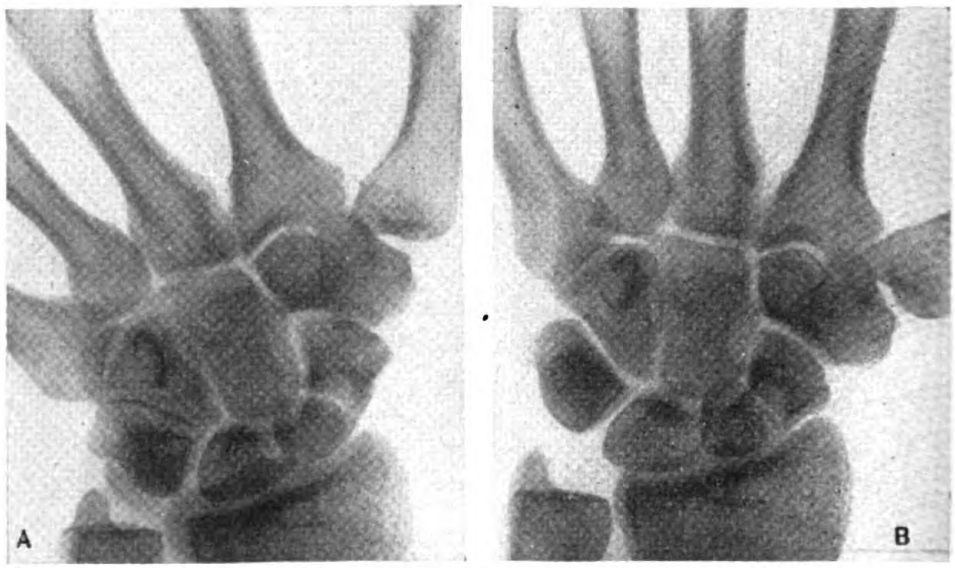
Case 2.—A radioman, second class, USN, 20 years of age, injured his right wrist in basketball practice when he fell onto the heel of his right hand with his arm outstretched backward and sideways. He was examined at sick call but no x-ray was taken. About 3 months later he complained of a weak, painful wrist and x-ray examination disclosed an old, incompletely healed fracture of the scaphoid. A plaster cast was applied from below the elbow to the metacarpophalangeal junction, with the thumb completely free, and was maintained in position for 6 weeks. Examination 15 weeks later showed the right wrist to be normal except for moderate pain over the scaphoid on forced radial deviation. Forced extension and flexion were painless. The patient is working as a radio operator, tapping with the index and middle fingers, keeping the fingers stationary but constantly moving the wrist. Such work tires his wrist but does not impair his ability to do full duty.

At the time of x-ray examination it was noted that the patient's right grip was much stronger than the left. He then revealed that his left scaphoid had

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been fractured 3 years previously when, fighting barehanded, he struck his opponent with his thumb. In the next 6 months he saw two physicians, neither of whom ordered an x-ray and both of whom diagnosed sprain of the wrist. The patient was at that time working as a ranch hand and was greatly handicapped in his work by the injury. He consulted a third physician who made an x-ray examination and applied a plaster cast from below the elbow to the metacarpophalangeal junction, with the wrist in neutral position and with the abducted thumb immobilized to the interphalangeal joint. That cast was maintained in position for 6 weeks. Improvement followed when the cast was removed, but the patient was still unable to bear his weight on his outstretched left hand. An x-ray of the left wrist showed fracture of the scaphoid, completely ununited 3 years after injury despite 6 weeks' immobilization in a cast applied 6 months after the injury occurred.

Case 3.—A seaman, second class, USN, 20 years of age, injured his right wrist while wrestling, when he was thrown violently onto his outstretched hand,



2. Case 3.—A taken 6 months after injury shows a fracture of the scaphoid with fibrous union. This patient had received no treatment when the fracture was discovered 6 months after injury. B taken 9 months after injury shows increased vacuolation along the fracture line. There was more disability. A cast was applied. The normal bony structure, except at the fracture line, justifies the use of a cast despite the age of the fracture.

falling backward and to the right side. He was told by a medical officer that the wrist was sprained and no x-ray was taken. Six months later x-ray examination showed fracture of the scaphoid of the right wrist with apparent fibrous union (fig. 2A), and no treatment was recommended. A month later the patient reported that his wrist ached for several hours after swimming and was moderately painful when he lifted heavy objects; pushing against his outstretched palm also caused pain. Examination showed a normal range of wrist motion but definite tabatière tenderness and pain on forced radial deviation of the hand. The grip of the right hand was very strong although slightly weaker than that of the left. The patient was able to do full duty as a cook and dishwasher and was able to box and wrestle without pain, although standing on his hands produced some pain. It was observed that the patient's wrists, hands, and forearms were very well developed and powerful.

Three months later the patient stated that his wrist was more painful, particu-

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larly when it was forcefully hyperextended. His grip was as powerful as ever. X-ray examination (fig. 2B) showed an increase in vacuolation along the line of fracture. Both bone fragments appeared to have normal structure except for some cystic degeneration. For this reason, despite the age of the fracture (9 months), it was decided to immobilize it for 2 months or if necessary for as long as 6 months.

TREATMENT OF FRESH FRACTURES.

There is some difference of opinion concerning the details of treatment of fresh fractures, but in our opinion these differences are minor. We usually leave the cast in position for fully 8 weeks. Roentgenographic examination will readily indicate whether the period of immobilization should be extended, but it is difficult to predict clinically, immediately after removal of the cast, whether a good result is to be anticipated. An apparently weak and painful wrist may recover normal function without further immobilization within 2 weeks as in case 6.

To secure absolute immobility of the wrist joint the cast must be skintight. No padding whatever is used. If the plaster is applied very wet, avoiding any pull, and the arch of the hand is carefully molded, one application of plaster will usually suffice for 8 weeks. The plaster should be rather thick around the hand and thumb because the patient will return to some sort of duty and the cast must be strong enough to withstand abuse. It should extend almost to the elbow to secure complete wrist fixation. The cast recommended is shown in figure 3. It will be noted that the thumb is strongly abducted and completely encased in plaster and that the wrist is extended in about 15° radial deviation. The fingers are free to move. We feel that optimal fixation of the fragments is secured by complete immobilization of the thumb, while Thorndike and Garrey (*3*) leave the thumb free, pointing out that the utility of the hand is thereby increased.

Regardless of the type of cast applied, the most important attribute of good treatment is immediate immobilization. The following cases are examples of early treatment.

Case 4.—A chief shipfitter, USN, 40 years of age, injured his right wrist when he tripped getting off a bus and fell forward onto his right hand, then toward his right side. He had fractured the lower third of his right forearm 23 years previously. X-ray examination showed a fractured scaphoid, and the following day a cast was applied which included the thumb to the interphalangeal joint, from the metacarpophalangeal junction to the elbow. The cast was left in place for 6 weeks, and when it was removed it was impossible to detect clinically that the wrist had been fractured. The patient states that he has experienced no further disability from the injury. X-ray showed complete bony union.

Case 5.—An officer, USNR, 36 years of age, injured his left wrist when he fell on a companionway, pitching forward and landing on his outstretched left hand. He did not recall the exact position of the hand. An x-ray showed fracture of the left carpal scaphoid in an area favorable for repair, and the

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following day a cast was applied from below the elbow to the metacarpophalangeal junction, leaving the thumb free. The wrist was held in slight dorsiflexion. The cast was left in place for 6 weeks and at the end of that time it was impossible to detect that the wrist had been injured. The grip was strong and painless, the range of motion was complete and painless, and there was no tabatière tenderness. X-ray examination, 45 days after injury, showed complete bony union.

BLOOD SUPPLY OF THE SCAPHOID.

Two patients (cases 4 and 5) received prompt treatment and attained ultimate perfect function. Another factor which may have contributed to the good result is the favorable site of the fracture.



3. The type of plaster cast recommended completely encases and strongly abducts the thumb. The wrist is extended, the fingers are free to move, the arch of the hand is snugly molded.

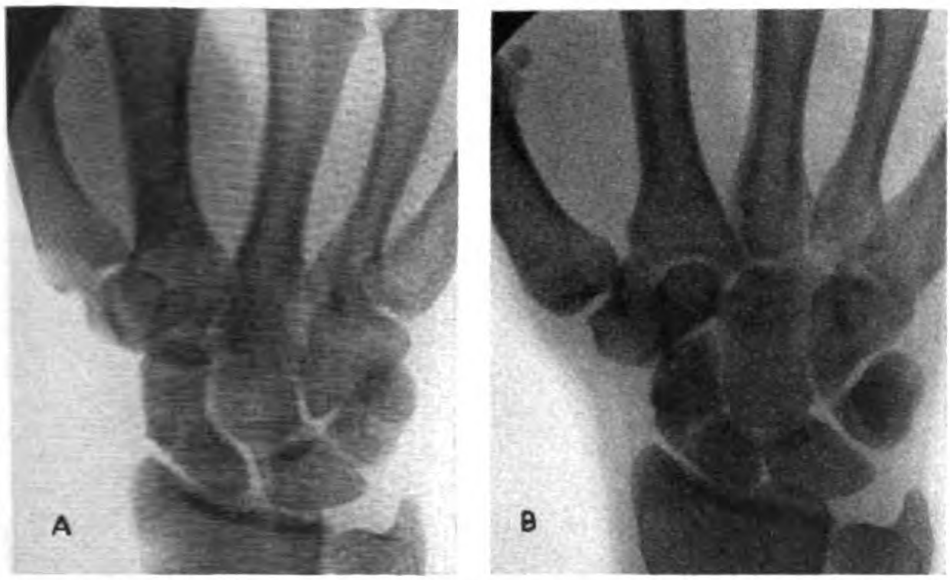
Fracture lines were toward the distal third of the scaphoid in each instance.

The main blood supply of the scaphoid comes from an artery which enters the midportion of the bone and then divides to feed the proximal and distal halves, a small artery entering the tuberosity to supply the distal half. Fractures through the midportion of the bone, then, may disrupt the blood supply so that the proximal portion receives very little or no blood. The fractured distal portion, however, continues to receive nourishment through the artery entering the tuberosity. Thus fractures through that portion have, theoretically, a better

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chance of complete healing than do fractures which disrupt the blood supply. As pointed out by Cave (*1*), however, early immobilization of the latter type of fracture provides an excellent chance for healing by permitting the reorganization and restoration of the blood supply. Delay, on the other hand, usually results in fibrous-tissue formation at the fracture site, creating a barrier which cannot be penetrated by blood vessels.

Soto-Hall and Haldeman (*2*) contend that the chief artery enters through the tubercle at the distal end of the bone, and one or more additional arterial foramina are found along various points of the body of the bone. They cite the finding of Obletz and Halbstein (*5*) that the proximal half of the navicular bone had no foramina, or only a single foramen, in about one-third of the specimens studied.



4. Case 6.—**A** shows healed fracture line in a case given prompt immobilization. **B** shows refracture 8 months after first injury. Following 11 weeks' immobilization, bony union occurred and wrist function is now normal.

In the following case there was a fracture and refracture through the vulnerable area of the bone, with excellent healing in each instance, despite a 2 weeks' delay and makeshift immobilization following the first injury. An apparently unfavorable type of fracture may, with proper treatment, have a good outcome.

Case 6.—A seaman, second class, USNR, 18 years of age, injured his right wrist when skating. His skate broke and he fell sideways onto his outstretched hand. The wrist was painful and stiff for 2 weeks. The patient then consulted a physician who made an x-ray examination and placed the forearm in a metal splint, leaving the thumb free. The arm was immobilized for 6 weeks. At the time of the patient's induction 2 months later he was able to climb a rope, hand over hand, without experiencing any discomfort in the wrist. On an x-ray taken 3 months later the old fracture line is barely discernible (fig. 4A). The following month the patient again injured his right wrist when he tripped over a bedpost,

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falling sideways onto the outstretched palm of the right hand. Immediate x-ray examination showed a new fracture through the old fracture line (fig. 4B), and a cast was applied to include the entire thumb, leaving the fingers free. Five weeks later a new cast was applied and the entire thumb left free. Six weeks later this cast was removed and the wrist found to be weak and painful. The grip was very weak and there was moderately severe tenderness over the scaphoid. Pushing against the outstretched palm, and extreme ulnar deviation of the wrist caused pain. Diving into the pool produced scaphoid pain, but swimming did not; the wrist tired with writing. X-rays made at this time revealed apparent excellent bony union, out of proportion to the clinical result. Wrist function was estimated at about 70 percent.

Examination 1 month later disclosed amazing improvement. The right grip equalled the left and was strong and painless, there was no tabatière tenderness, and extremes of wrist motion were painless. Wrist function was estimated at 95 to 100 percent. This excellent eventual result might have been anticipated by the x-ray findings upon removal of the cast.

THE MECHANISM OF FRACTURE.

Each patient in the present series was carefully questioned in regard to the position his hand and wrist assumed when the injury occurred. Hyperextension of the wrist, radial deviation of the hand, and sudden imposition of force are essential in the production of this fracture.

An analysis of these cases shows that the majority of patients fell onto the outstretched hand, the hand usually being extended to the side or back of the patient at the moment of contact. In this position the hand was extended to a greater degree than if it had been reaching toward the front, and it was probably forced into radial flexion on impact. In two instances boxing forced the wrist into sudden and extreme extension; the element of radial deviation is known to have occurred in one of these (case 2) inasmuch as the patient hit his opponent with his thumb.

The following table summarizes the type of activity engaged in at the time of fracture, the kind of injury or fall sustained, and when possible the exact position of the injured member at the moment of the impact. The wrist involved and the patient's age are also given.

TABLE 1.—*Etiologic details*

Type of activity	Character of injury	Position of hand	Wrist injured	Age
Boxing with gloves	Struck opponent's gloved hand as opponent simultaneously struck out.	Forced into hyperextension.	Right	18
Fighting barehanded (1st injury).	Struck opponent with his thumb.	Unknown	Right	17
Basketball, shooting a basket (2d injury).	Fell onto hypothenar eminence of outstretched hand.	To the side and behind.	Right	20
Wrestling	Thrown down onto outstretched hand.	Backward and to the side.	Right	19
Getting off bus	Tripped and fell onto outstretched hand.	Forward, and then rolled toward his side.	Right	40
Going down a ladder	Pitched forward and landed on outstretched hand.	Unknown	Left	36
Skating, skate broke (1st injury).	Fell onto outstretched hand	Sideways	Right	18

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TABLE 1.—*Etiologic details*—Continued

Type of activity	Character of injury	Position of hand	Wrist injured	Age
Tripped over bedpost (2d injury).	Fell onto outstretched hand.	Sideways	Right	19
Playing football	Slipped and fell with hand outstretched.	Sideways and backward.	Left	19
Rigging a bell, standing on chair on top of desk.	Chair slipped, patient fell to floor with hand outstretched.	To the side	Left	42
Pushing car	Slipped and fell, turning complete somersault.	Unknown	Left	18
Climbing ladder	Fell backward onto deck onto both outstretched hands.	Both hands behind him.	Left	23

TREATMENT OF OLD UNUNITED FRACTURES.

How old must an untreated, ununited scaphoid fracture be to preclude trial immobilization in plaster? We believe the age of the fracture in itself is no criterion but that the x-ray appearance of the bone is the best indicator. If both fragments show normal bone structure, the wrist should be fixed in plaster for a period of 2 months or more. Böhler (*4*) warns that no fracture showing bone necrosis should be immobilized. When marked opacity of the fragments appears on the x-ray, or there is other evidence of eburnation of bone in fractures more than 6 months old, the use of plaster casts is contraindicated.

In the opinion of Thorndike and Garrey (*3*) only the rare ununited fracture will require surgery at any time. Of 10 patients observed by them over a period of years none showed definite disability. Kreuz (*6*) believes that all acute navicular fractures, after reduction, should be immobilized for at least 6 months before open reduction is considered. He states that if the fracture is more than 6 months old when first seen, and if the fragments are viable and not producing secondary arthritic changes, the fracture should be reduced accurately and a small central bone graft inserted.

Though x-ray evidence will usually rule out the case which will not benefit by fixation, it is not an infallible indicator of disability. A combination of x-ray and clinical examination must be used to determine when surgical intervention is necessary. If immobilization is useless, as determined by x-ray evidence, and there is considerable disability, surgery should be undertaken.

From a perusal of the recent literature on the old ununited scaphoid fracture the following conclusions are drawn:

1. The entire scaphoid bone should never be removed.

2. If the proximal portion of the scaphoid is comminuted, this portion should be removed entirely in order to prevent arthritis of the radiocarpal joint (*1*).

3. Drilling of the ununited fragments is less frequently advocated than formerly (*1*) (*2*).

4. The accepted operative procedure at present consists of the insertion of an autogenous dowel graft into a drill hole through both fragments (*1*) (*2*) (*6*).

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5. The proximal fragment, if too small to warrant insertion of a bone graft, may be removed (*2*).

THE X-RAY.

The x-ray film may fail to show an early impacted fracture. As much as 3 weeks may elapse before sufficient absorption has occurred at the fracture line to permit visualization (*2*). When a fractured scaphoid is suspected, the wrist should be kept immobilized during this period and check x-rays taken; negative x-ray findings after 3 weeks are a safe indication for abandoning immobilization.

A trial period of immobilization should be instituted for all scaphoid fractures, however old, if both fragments appear to be normal bone and in good position. If either fragment of an old fracture exhibits increased density, the fracture should not be immobilized (*4*).

The so-called cystic degeneration which takes place between the bone fragments (actually absorption of bone along the fracture line and its replacement by fibrous tissue), and the increase in bone density, usually of the proximal fragment or along each margin of the fracture, are both a measure of the defect in the local blood supply.

X-ray evidence is the only reliable criterion of bony healing; clinical impressions of wrist strength and evidences of pain are untrustworthy. The cast should be maintained until the fracture line has been closed in by bone as shown on x-ray examination.

CONCLUSIONS

1. The incidence of fracture of the carpal scaphoid is apparently higher in military than in civilian life, this type of fracture greatly outnumbering Colles' fractures in this hospital.

2. Fractures of the scaphoid bone are frequently overlooked. The diagnosis of sprained wrist should never be made until x-ray evidence has ruled out the possibility of fracture of the scaphoid.

3. Immediate immobilization of the fractured scaphoid will yield excellent results in nearly all cases.

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FRACTURES OF THE MANDIBLE

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The treatment of fractures of the mandible, utilizing opposing teeth in the dental arches, has varied from time to time. One of the earliest types of fixation was interdental wiring. The teeth in the opposing jaws were brought into occlusion by manual reduction and held there by wires twisted from the uppers to the lowers. This was known as the Gilmer method, and is still used extensively today.

During the first World War, when patients were transported across the usually rough English Channel, this type of wiring was varied somewhat to permit easy opening of the jaws without having to do the entire process over again when the emergency was over. Thus the Ivy eyelet method came into being.

Except for various types of fixation used in specific cases, the Gilmer and Ivy methods were the only ones used until fracture bars came into general use during the past decade. Their use has permitted an easy and uniformly satisfactory elastic intermaxillary traction for the reduction of mandibular fractures. It also made possible the obtainment of correct occlusion in cases of fractured maxillas, in conjunction with other necessary treatment.

Those of us who believe that rigid fixation of the lower teeth against the upper is not necessary, and that a little movement is beneficial, find this very aptly described in an article by Kazanjian and Strock.[1] Orthopedic surgeons are well agreed that the maintenance of some function during treatment of fractures makes for much earlier union and a better callus formation. External pin fixation, bone plating, walking casts, and various other contrivances are used whenever possible. The patients are back to duty earlier and muscle atrophy is much less apparent. This, plus elimination of manual reduction, is the strongest argument for intermaxillary elastic traction.

The main purpose of this paper is to discuss a method of obtaining reduction of mandibular fractures by the use of elastic intermaxillary traction. This method is a variation of "Intermaxillary multiple loop wiring," described in a recent Research Council issue.[2]

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[1] Kazanjian, V. H., and Strock, M. S.: Early treatment of fractures of mandible. J. Am. Dent. A. 29: 76–83, January 1942.

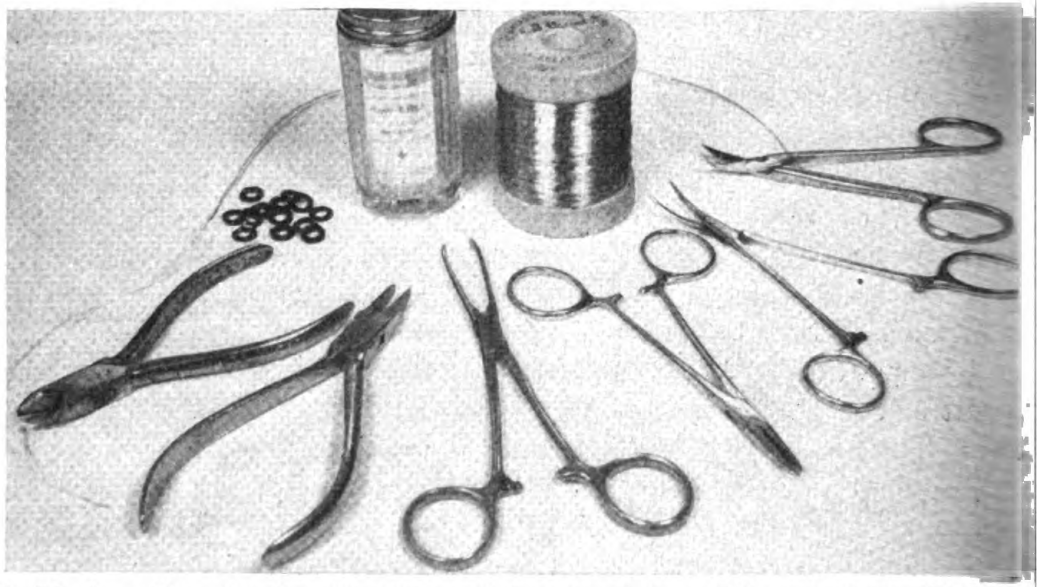
[2] National Research Council, Committee on Surgery: Manual of Standard Practice of Plastic and Maxillofacial Surgery (Military Surgical Manuals, No. 1). W. B. Saunders Co., Philadelphia, 1942. pp. 272–276.

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The armamentarium is simple (fig. 1), consisting of the following:

1 5-inch mosquito hemostat.
1 small nonserrated pliers.
1 wire cutter.
30-gage stainless steel wire.
Dental floss.
3-inch piece of 6-gage lead wire.
Rubber bands.

Additional but not obligatory instruments are one more each of straight and curved hemostats, Allison's forceps, and a pair of crown and bridge scissors. These are especially useful in the application of



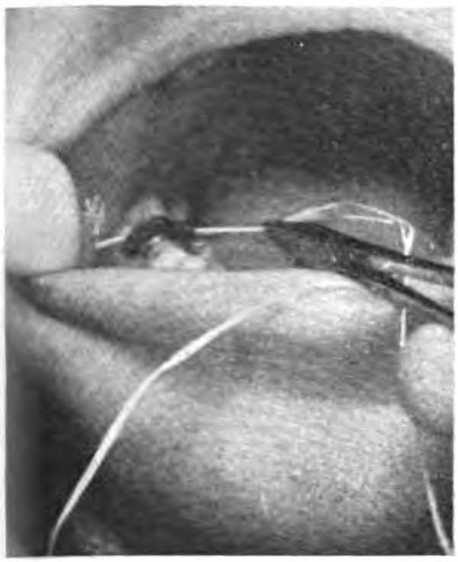
1. Black rubber bands are used mainly for photographic purposes. Stethoscope tubing when cut up makes excellent elastic traction. The doubled strand of wire in the background, with the dental floss attached, is ready for use.

fracture bars, the use of which this writer finds necessary for the treatment of some cases.

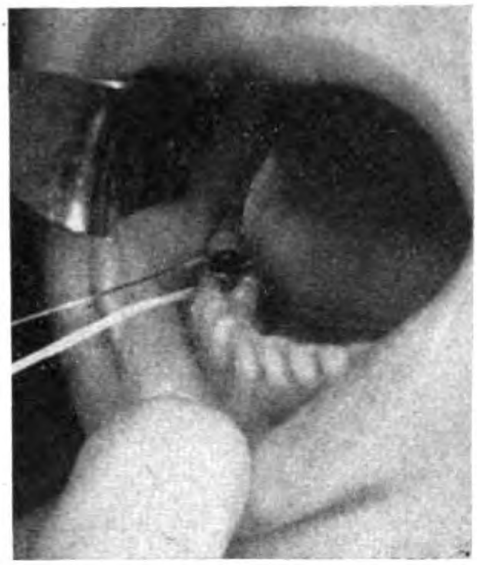
A piece of the stainless steel wire, 26 inches long is doubled on itself and the free ends twisted together. Dental floss is passed through the resultant loop and pulled taut. The double strand is then used as a single wire (fig. 1).

We will now consider the application of this wire to all the lower teeth from the lower right second molar to include the lower right central incisor. The dental floss is grasped with the hemostat and left hand and forced through the contact distal to the second molar (fig. 2). Then before pulling the wire through, the floss is forced down between the second and first molars (fig. 3). The dental floss is engaged by the hemostats and the wire is pulled around the second molar in one movement until the opposite end is adjacent to the lower left incisors (fig. 4). The long strand, with the dental floss attached, passes underneath the short buccal strand.

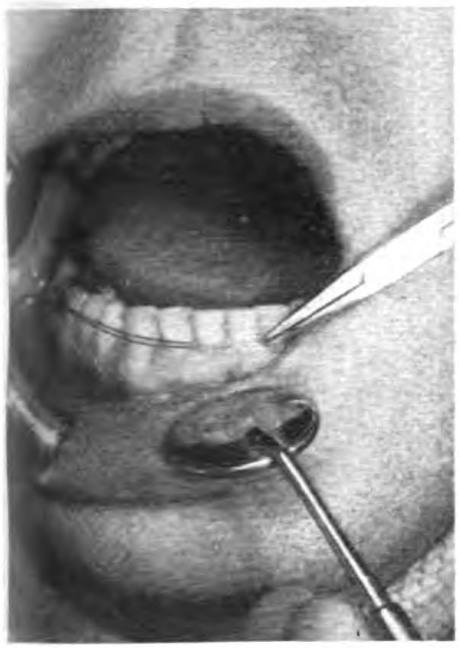
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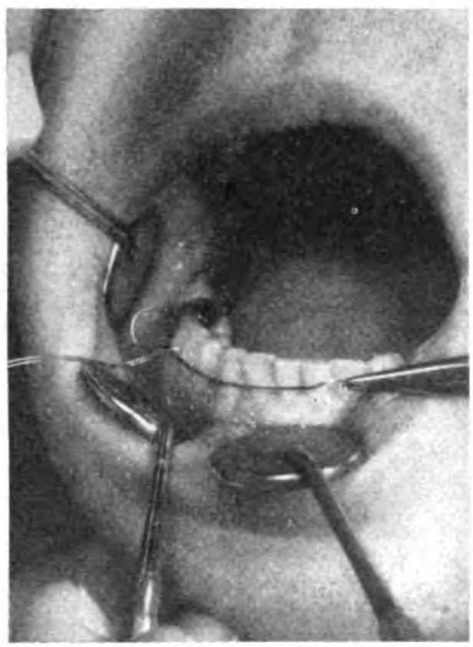
2. Dental floss grasped with hemostat held in right hand and fingers of left hand. The wire leads off to the left. The floss is forced down between the contact points of the second and third molars.



3. The dental floss is forced down through contact distal to the first molar, ready to pull the wire around the second molar, which in this case has a gold crown.



4. Wire pulled around the second molar in one movement until the opposite end (grasped in hemostat) reaches the lower left lateral incisor. Note that the long strand, leading to the left, is underneath the short buccal strand.



5. Dental floss forced back through between first and second molars, and out between first molar and second bicuspid. It is then pulled so that wire passes around the first molar until loop is formed around the short buccal strand, ready for insertion of the lead wire.

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The dental floss is now forced back through the same interproximal space (between first and second molars) and out between the first molar and second bicupid, passing around the first molar. It is again grasped with the hemostat and the wire pulled around the first molar, forming a loop over the short buccal strand. When the wire is pulled through to where the loop is quite small (fig. 5), the lead wire is inserted and the steel wire pulled snugly against it, with the lead wire resting firmly against the buccal surfaces of the teeth in a horizontal position (fig. 6).

At this time the lead wire is removed and the pliers are used to make a three-quarter turn of the resultant loop over the buccal strand (fig. 7).

The foregoing process is repeated (fig. 8) until the mesial of the right central incisor is reached. At this point, the two free ends of the wire are twisted together.

The pliers are now applied to each loop and usually one complete turn is sufficient to cinch up the strands to adequate tautness. The twisted ends are also cut, tightened, and bent out of the way or down as a hook for a rubber band (fig. 9).

Next the loops are bent down against the gingiva (fig. 10). The final forced bending is done, rather hard against the tissues, after the rubber bands have been applied.

The other three sections of the mouth are done in a similar manner. The molar and bicuspid areas, and usually the upper anteriors, are relatively easy; the lower anterior teeth are, more often than not, in malposition, and so considerable perseverance is needed to obtain loops in that area. I have often had to discard the dental floss, cut the doubled end of the wire, and thread the individual strands through between the teeth singly. This is not a disadvantage peculiar to this method, as there is the same difficulty with other forms of wiring; more so if a larger gage is used.

Twenty-four to 28 hooks are provided for the application of rubber bands, if there is a full complement of teeth. This is usually more than necessary. Very often the inclusion of the first molar and cuspid is sufficient in simple fractures with little or no separation of fragments and good alinement.

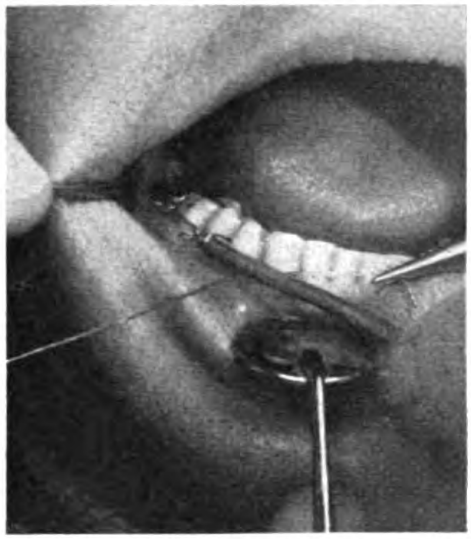
This is one of the few operations in dentistry that is easier to do in the mouth than on models. However, it is hard to grasp the proper sequence from a written description. Therefore, better success can be anticipated on the first practical attempt, if it is carried out step by step on a model at some previous time.

Since the use of multiple loop wiring was begun at this activity, 10 months ago, it has been used routinely on all cases indicated, and on some which seemed unfavorable, for a total of 83 patients. Two of these were failures. One failure was because of wide proximal spaces

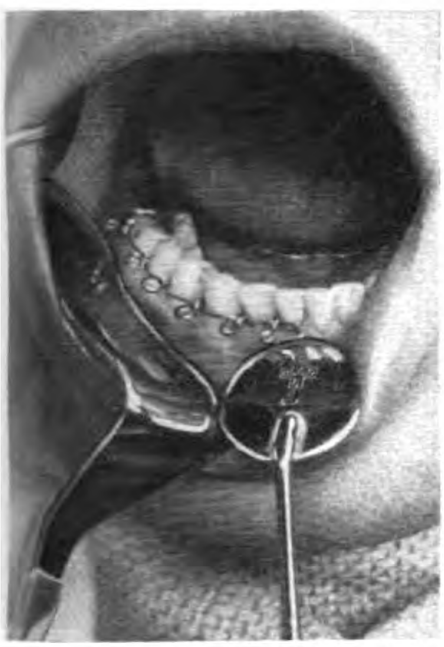
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6. Lead wire inserted in loop and steel wire pulled snugly against it. Note finger at distal end of lead wire to counterbalance pull on steel wire in opposite direction. This causes less trauma and pain at fracture site. The short buccal strand is also within the loop formed over the lead wire.



7. Loops have been formed between the first and second molars, and between the first molar and second bicuspid. The lead wire is ready for removal so that a loop can be formed between the bicuspids.



8. All loops have been formed. The two free ends of wire are twisted together and cut. Further tightening is now necessary, usually one complete turn at each loop.



9. Loops are bent down with hemostats to engage rubber bands.

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between the teeth of the upper and lower jaws, allowing the wiring to slip off. The other failure was due to the fact that the patient was still irrational from a skull fracture and pulled the wires off. In these instances, fracture bars were used successfully. I have recently devised a method of wiring teeth with from 1 to 2 mm. distance between the contact points. By twisting the 2 strands of wire together for a distance of about 1½ cm., an additional length is obtained which can be turned into a loop. This is illustrated in figure 11 where such a space exists between the upper right first bicuspid and cuspid. I have not given this a thorough trial yet but believe it should work satisfactorily.

The long and short strands can also be twisted together to bridge across spaces where teeth are missing (fig. 11). With the help of dental floss, rubber bands can be looped around this strand and hooked or tied to the opposing arch.

One of the main advantages of the multiple loop wiring method is the ease and speed of application. In my hands it has been much faster than any other method I have used. Where the teeth are in good alinement and contacts are normal, the time of application is seldom over 30 to 40 minutes for the complete upper and lower arches. More difficult cases, those with missing teeth, poor alinement, and faulty contacts, usually take no more than 1 hour. Figures 12 and 13 illustrate a good case for wiring.

Another distinct advantage is the lack of tooth movement. A well adapted or cast fracture bar reduces this very well but not to the minimum obtained with multiple loops. Figure 12 illustrates a situation that arose in which the two upper central incisors were out of line distally and began to separate. This was quickly overcome by tying the two sections of wiring together as illustrated. It is good practice to connect the separate sections in the same arch so that the foregoing cannot occur. Except for this, I have seen no teeth loosened because of this type of wiring.

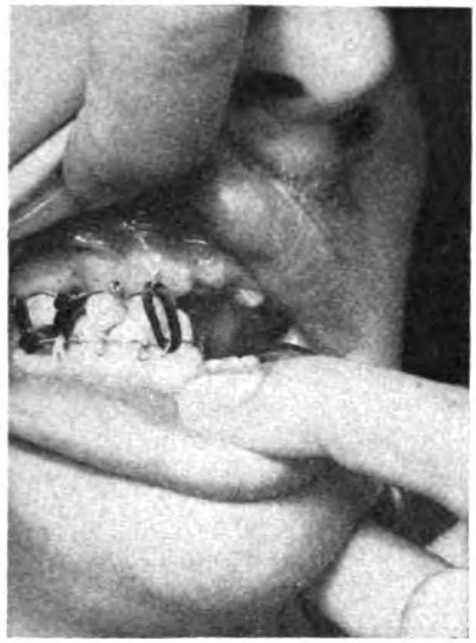
A third advantage is cleanliness. Figures 12 and 13 illustrate a case after 6 weeks. There was no prophylactic measure used except frequent irrigations, other than the excellent and unusual care the patient rendered himself. Stainless steel wire does not corrode and thus has a distinct and indisputable advantage over brass or bronze. Gingivitis occurs much less frequently, and is more easily controlled if it does invade the tissues, when stainless steel wire is used.

An important consideration in the use of stainless steel wire is the gage. I have tried a great many and have found that 30 gage is the best. Anything finer is too weak. If larger, it is hard to work with and tends to return to its original shape too readily. It must be doubled or it is not strong enough. It is tough and will take lots of

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10. All loops are bent down against the gingiva. Seven hooks are provided for rubber bands in one-fourth of the mouth.



11. Loop in upper jaw without band illustrates one formed where space of about 2 mm. exists between the contact points of the cuspid and first bicuspid. Also illustrated is manner in which spaces due to missing teeth are provided for. The posterior rubber band is looped around the lower twisted wire and slipped over the hook above. The next rubber band is looped over the upper strand and tied to the lower strand. Case pictured is 3 weeks after treatment was begun.



12. Case 6 weeks after application of wires. Upper centrals had begun to spread but this was overcome by connecting the two upper sections of wiring.



13. Lateral view of case shown in fig. 12. Some rubber bands have been removed better to illustrate cleanliness possible and healthy condition of the gingival tissues. This was mainly due to the diligence and perseverance of the patient.

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punishment. However, one must learn to handle it with instruments; usually hemostats are the ones of choice. Very often the patient with a fractured jaw cannot be encouraged to open his mouth far enough to accommodate dental floss or wire grasped in the fingers.

Wire of the same gage varies with the manufacturer. Wire is available on the supply table. The catalog numbers are 2–1085, 2–1090, and 2–1095. These give 32, 28, and 26 gages respectively, and can be used in lieu of the 30. The 30-gage used at this activity is obtained through open purchase. The main object is to have it large enough to support the rubber bands, yet as small as possible for comfort to the patient and minimum encroachment on the gingival tissue.

Although the thought of economy did not enter when the use of multiple loop wiring was begun, it has been a resultant factor.

While discussing advantages, the small amount of space occupied in the mouth deserves mention. The wiring fits snugly against the teeth and gingiva and causes a minimum of irritation to the mucous membrane. Patients complain of it less than of any other form of immobilization.

Disadvantages of multiple loop wiring are few and affect only a small percentage of cases. It has been unsuccessful where there are spaces between the contact points of adjacent teeth. The loops formed by the wires are not as strong as the hooks on fracture bars. The multiple loop method has not proved its worth in the case of patients evacuated from the battle front to the mainland, whereas fracture bars and rubber band traction have. This method has no place where extra-oral traction is to be applied, as in the reduction of a fractured maxilla.

One of the greatest changes in the treatment of jaw fractures since the adoption of intermaxillary elastic traction, came with the advent and general usage of the sulfa drugs. Whether or not a tooth in the line of fracture should be removed immediately at the onset of treatment, has been, and doubtless will continue to be, a popular and controversial topic of discussion. It has become my practice to leave all such teeth in place if it seems at all possible and if they are not actually causing displacement. Sulfathiazole is administered for a period of 4 days or until the swelling has subsided. Usually the tooth can be kept in position and correct relationship of the fragments maintained during immobilization. If after 4 to 6 weeks the union seems weak, the offending tooth can be removed and a few days more immobilization provided. In most cases the weakness disappears and good firm union is evident after 4 or 5 days. This phenomenon, which I have not seen described in the literature, is most noticeable in the symphysis and mental areas. If the tooth "blows up" during the treatment period, it can be removed at that time. In a great many cases, a better occlusion and approximation of fragments is gained and main-

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tained by this procedure than if the tooth had been removed at the beginning. Judgment and past experience must guide one in the decision of when to extract and when not to, and there must be exceptions to all rules.

Because of the sulfonamides the fear of osteomyelitis as a complication accompanying compound jaw fractures is practically a thing of the past. Most of the patients coming in from the far battle fronts are remarkably free from infection. They usually are wearing appliances, having been immobilized for from 3 to 8 weeks. It only remains to remove the appliances and offending teeth; as far as the jaw fracture is concerned, the patient can be dismissed. Practically all of these patients have had sulfa therapy.

Fracture bars, with rubber band intermaxillary traction, have been used most frequently on patients admitted under treatment. I believe that the more teeth wired to a fracture bar the better. All first molars, all bicuspids, and all the anteriors should be included. If the fracture bar is well adapted, there is less loosening of teeth if all those mentioned are wired. Thirty-two gage stainless steel wire, doubled, seems best for this, although 30 gage is very satisfactory. In a bone graft case, such an appliance was in place for 12 weeks. No adjustments were necessary and the condition of the teeth and surrounding tissues was good.

SUMMARY

During the past 16 months, 188 fractures of upper and lower jaws have been treated at this activity. The Gilmer and Ivy methods have been used for direct fixation. Intermaxillary elastic traction, regardless of how it is obtained, is usually the method of choice. Multiple loop wiring has proved the most satisfactory in the hands of the writer. Chief advantages of this method are ease and speed of application, lack of tooth movement, cleanliness, and economy of cost and materials. The sulfa drugs play a large part in the treatment of compound fractures. Stainless steel wire is eminently satisfactory if the size is kept small and if it is handled with instruments.

Acknowledgment.—Credit is due Lieutenant Commander Percy A. Wynn, Dental Corps, United States Naval Reserve, for making the photographs.

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THE USE OF SPECIAL VIEWS IN ROENTGENOGRAPHY OF THE KNEE JOINT

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The incidence of internal derangement of the knee joint is especially high in young male adults, a group of individuals comprising the majority of naval personnel. Excluding the use of pneumography, or examination with other contrast agents, many types of internal derangement, such as osteochondritis dissecans, osteochondromatosis, calcification of the semilunar cartilages, and traumatic affections (old fractures involving the patella, tibial spines, etc.), may be revealed by roentgenograms.

It has long been recognized that routine anteroposterior and lateral roentgenograms of the knee joint are not adequate for accurate diagnosis in many cases, but in spite of this, it is generally customary to take only these two positions. Our experience at this hospital leads us to believe that a view of the intercondylar notch should be obtained in all cases. Moreover, when any disturbance of the patella is suspected, special views of the patella in both the vertical and transverse planes should be taken also.

The following two cases illustrate the importance of these special views in a study of the knee joint.

CASE REPORTS

Case 1.—In 1938, a hospital apprentice, first class, age 21 years, injured his right knee in football. For 2 weeks the knee was swollen and painful. No further trouble was encountered until 1940 when a similar injury occurred. Since then there have been occasions of locking, pain, and swelling.

Physical examination revealed a palpable loose body in the suprapatellar pouch, and audible crepitus. The knee locked when in full flexion.

Roentgenograms revealed not only the loose body felt on physical examination, but also a second loose body in the intercondylar space (fig. 1).

Operation disclosed the two loose bodies which were seen in the roentgenograms. They were removed easily. The postoperative course was uneventful, and the patient returned to duty without incidence.

Case 2.—A carpenter's mate, third class, age 20 years, injured his left knee in a motorcycle accident in 1939. He had pain and swelling for 4 weeks. His convalescence was gradual but complete until 1940 when he noticed occasional recurrent pain and swelling following prolonged use. There were several instances in which his knee gave way, but no true locking was experienced.

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Physical examination revealed diffuse swelling of the left knee and tenderness over the lateral aspect of the left patella. Range of motion was complete, though full flexion was painful. There was no instability.

Roentgenograms taken in the conventional manner were negative. Because the patella was the apparent seat of the difficulty, a roentgenogram was made in the vertical projection and this revealed an old ununited fracture of the lateral portion of that structure (fig. 2).



1. Intercondylar notch position revealing loose osteocartilaginous body in the intercondylar space.

Operation disclosed a nonunion of the lateral one-fourth of the left patella. The fragment was excised. Complete examination of the knee joint at this time did not reveal evidence of any other abnormality. The postoperative course was uneventful. For several weeks the patient continued to complain of some pain on walking, but this gradually subsided, and he was returned to duty. He was reexamined several months later, at which time there were no objective findings and no complaints.

ROENTGENOGRAPHIC TECHNIC.

Intercondylar notch position.—The patient is placed in the prone position upon the radiographic table and the affected knee flexed to an angle of 40°. The elevated lower leg is supported upon an upright sandbag or other suitable rest. The x-ray film, preferably of the no-screen type, is placed beneath the front of the knee joint and centered 2½ inches below the center of the joint. The x-ray tube

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is angled 40° cephalad so that the central ray emerges at the center of the film. The flexion of the knee joint and the angulation of the x-ray tube will cause the shadow of the intercondylar notch to be projected clear of the shadows of the patella and tibia.

Vertical view of patella.—The patient is placed in the prone position on the radiographic table and the affected knee flexed as much as possible by having the patient pull upward on the foot with his



2. Vertical projection of patella revealing an ununited fracture of the lateral portion of the patella.

hand. The x-ray film is centered directly beneath the vertical axis of the patella. The x-ray tube is centered so that the central ray will coincide with the vertical axis of the patella. This may vary slightly depending upon the degree of flexion of the affected joint. Normal irregularities on the anterior surface of the patella should not be mistaken for evidence of disease, and, in cases of doubt, a roentgenogram of the opposite patella should be made for comparison.

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THE TREATMENT OF BURNS

A DISCUSSION BASED ON EXPERIENCE WITH 360 CASES SEEN ON BOARD A U. S. HOSPITAL SHIP (CONCLUDED)

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Under the term *secondary local treatment* we include measures that must be applied to burns that have not healed under the primary local treatment, that is, burns that have become infected, and burns of such extent and depth as to require skin-grafting.

Second-degree burns may become infected, but when the infection has been mastered, they will heal without grafting. Infected third-degree burns, if not too extensive, will likewise heal without grafting, once the infection has been controlled. It is surprising, at times, to see how rapidly and extensively a third-degree burn will become epithelized. Usually this is due to the fact that in such cases regeneration of epithelium takes place not only from the outer margins—a slow process that rarely exceeds a quarter of an inch in a week—but also from little islands of surviving epithelium beginning at the edges of hair follicles. The survival of these islands, however, is contingent upon their escaping destruction from infection, an eloquent reason, therefore, for prophylaxis and the early elimination of such infection.

Large areas of third-degree burns and practically all fourth-degree burns will require skin-grafting. The sooner such grafting can be carried out, the less likely is it that scar formation, with its inevitable contractures and deformations will be encountered. This feature is the most serious of the late complications of burns. But before such areas are ready for skin-grafting, they must be rid not only of gross infection but likewise of necrotic tissue. In deep burns there is much devitalized tissue that undergoes liquefaction necrosis and sloughing, even in the absence of infection. Infection consequently finds a ready

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soil under such circumstances. Therefore, more frequent changes of dressings are necessary for the control of infection and to permit the surgical removal of necrotic tissue.

To restate it, then, the purpose of secondary local treatment is (*a*) to clean up infection, and (*b*) to prepare deeply burned areas for skin-grafting. These aims obviously restrict the number of applicable measures to comparatively few. More specifically, they rule out for secondary local treatment a number of measures commonly employed in the primary local treatment of burns, such as paraffin-wax, triple dye, and tannic acid. These three methods must not be used after infection has already established itself and they must be discontinued moreover, if and when a burn primarily so treated becomes infected. Frequently they are used in such instances, chiefly, it would seem, because the medical officer had not provided himself with, or could not get sufficient other materials to treat large numbers of patients.

Sulfathiazole, on the other hand, is applicable at any stage in the treatment of burns. As an ointment, provided it is in a water-soluble base, it may be used in the presence of moderate degrees of infection, notably of second-degree burns. The infected area, however, should be cleansed of pus with sterile saline solution and sterile pledgets of cotton before application of the ointment. In most cases, and always in the secondary local treatment of infected deep burns, we have used microcrystalline sulfathiazole powder in conjunction with wet saline dressings. The microcrystalline powder possesses several advantages. It is easily and quickly applied by means of an ordinary atomizer. A thin film of powder can be evenly applied to extensive areas, yet with the expenditure of very little powder, an important economic advantage. It does not cake on the burned area as does the ordinary sulfathiazole powder. By virtue of the high surface area in proportion to the mass of its tiny crystals, it goes into solution much more readily and therefore promptly exerts its bacteriostatic action.

In the absence of microcrystalline sulfathiazole powder, the ordinary powdered sulfathiazole, although much less desirable, should nevertheless be used. Unfortunately, it cannot be applied with an atomizer, but a shaker-top container will serve the same purpose.

Our usual procedure, then, in the secondary local treatment of most burns is as follows. The burned area is mechanically cleansed with warm sterile physiologic saline solution. Bits of necrotic tissue are cut away, using sterile scissors and forceps. Crusts of dried secretion are softened by soaking and then removed. It is especially important to remove completely the crusts about the ears and nose at each dressing. Infection under the crusts not only delays healing but tends to destroy the highly vulnerable cartilage of these structures. The microcrystalline sulfathiazole is then blown on so as to

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cover all areas devoid of epithelium and likewise liberally beyond the margin. Sterile gauze dressings wet with physiologic saline solution are then applied and held in place by ordinary gauze bandages snugly fitted to the extremities, or taped with adhesive straps. Other suitable binders for the trunk may be used. The dressings must be kept wet and they should be allowed to remain in place as long as is consistent with the satisfactory progress of the wound. When there is free secretion and considerable sloughing of necrotic tissue, this may be only 24 hours. But when the decreased amount of drainage permits, the dressing is left on for 48 hours or longer.

Before the dressings are changed, they should be thoroughly wet down with warm saline solution. Hands and feet are soaked in a sterile basin with warm saline. This permits relatively painless changing of dressings—an important point in as far as the endurance of these patients is considerably overtaxed.

Various expedients have been tried to prevent the dressings from sticking to the burn surface. None has been wholly successful. Some have used a layer of cellophane between the gauze and the wound surface. One of us (H. M.) has used waxed paper in the same way. This does not stick to the wound; the secretions can escape around the edges of the paper. But if the pieces are large, or not supplied with perforations, pus is kept unduly in contact with the burn area.

Under these measures two things may occur. The infection clears up fairly promptly and satisfactory epithelization progresses, not only from the edges of the wound, but from islands of epithelium in various parts of the burn. The secretion becomes scant and is of a clear straw color. Under these circumstances the most advanced portions can be left uncovered, save for a free application of the sulfathiazole powder. Some of these areas will obviously be healed in a day or so, as shown by the dry surface of the thin epithelium. Others will ooze and crust. For the most part the crusts need not be disturbed, since they separate spontaneously as the epithelium forms beneath them. Others, especially if infection again develops under them (tender spots, cracks that exude a little pus), are best softened by a wet dressing and then removed. The wound then is given another application of sulfathiazole powder and subsequently handled with wet or dry dressings, as indicated.

The other possibility is that the infection clears, but the burn surface presents large areas of 1 inch or more in their smallest dimension that are devoid of epithelium and obviously require skin-grafting. In the region of joints, especially the knuckles of the fingers, much smaller denuded areas call for grafting to insure early healing. When the wound is free of necrotic tissue and its surface is covered with healthy granulations, skin-grafting is in order. As previously stated,

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the sooner the grafting is carried out, the less scarring and deformity will result from deep burns.

In most cases split grafts are the grafts of choice. Pinch grafts may be used to advantage when one is dealing with multiple smaller areas of granulations with islands of skin between, or when one wishes to stimulate the epithelization in a larger area which is not yet clean enough to receive large split grafts. Exuberant granulations should be prevented, if possible, by pressure dressings, and when they do develop, should be trimmed away flush with the skin surface with scissors or a stick of silver nitrate. At the time of grafting, hypertrophic granulations may be shaved off with the razor to produce a firm flat surface upon which the grafts readily grow. The oozing that occurs at this maneuver can easily be controlled by pressure. A small-mesh gauze (sterile bandage gauze) is used over the granulating area.

In dressing the grafted areas, we use the same technic, including the microcrystalline sulfathiazole powder spray. Even after grafting, we believe that much benefit is to be derived from getting the patient out of bed as early as possible. Splints are used to immobilize the grafted area for a time, especially when this involves the region of a joint. Skin grafting is often accompanied by a considerable loss of blood. These patients therefore are given a blood transfusion on the day of grafting, both in order to replace the loss of blood and to stimulate healing.

Some data and suggestions based on personal experiences.—This report is based on records of 360 patients with burns that were treated by us during some or all of their course. They are not all the patients with burns we have seen here on board this ship. Thus we have included only one of many cases of sunburn, a wounded man adrift for 13 days and sunburned over his whole body. (Nearly all of the shipwrecked presented various degrees of sunburn, especially of the face, hands and feet, the latter due to the discarding of shoes in the water.) Nor have we listed a number of cases of minor burns in patients admitted primarily because of wounds.

TABLE 2.—*Causes and relation to battle action of burns in 360 patients*

	Due to battle	Not due to battle		Due to battle	Not due to battle
Flash burns	254	1	Chemicals (3 lye, sulfuric acid)	0	4
Gasoline	41 (15)	38	Electrical burns	0	2
Fuel oil	16 (6)	0	Miscellaneous (hot metal, sun)	2	5
Friction	15 (7)	0			
Steam	4 (1)	2	Total	303	57
Hot liquids (3 coffee, water, grease)	0	5			

It is evident in table 2, that the great majority of burns were incurred as a result of battle action. Flash burns account for most

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of these, although patients were often indefinite as to the manner in which they had been burned. Some had knowledge of two or more causes, such as a gasoline fire in addition to powder explosion. Such duplications are indicated by the figures in parentheses. Thus, of the 15 men who had suffered friction burns, usually of the hands, while sliding down a rope in abandoning ship, 7 also had received flash burns from exploding projectiles or torpedoes. One burned his hands on the hot metal rungs of a ladder. Almost without exception the battle burns were incurred during naval action; a few in planes.

There were a fair number of burns, however, not due to battle action. Their causes are worth mentioning, chiefly to point out that many of them were preventable. Of the 38 gasoline-fire burns, 17 were incurred in connection with cooking, usually when men ashore attempted to start or feed a fire by pouring gasoline into the fire or the stove. Plane crashes accounted for 8. One of the kerosene burns resulted through the upsetting, in a life boat, of a small stove that was being used to distill fresh water from sea water for survivors of a small ship that had foundered in a gale. The two steam burns were due to negligence that let steam be turned into a boiler in which the men were working. The burns from lye were due to careless handling of the caustic and usually included involvement of the eyes.

TABLE 3.—*Parts of body involved by burns in 360 patients*

Part	Number of cases	Part	Number of cases
Face	212	One forearm	21
Both hands (largely dorsum)	181	One shoulder	18
Both arms (upper and forearm)	85	One thigh	18
Back	67	One ankle	17
Both forearms	52	Both shoulders	16
One hand	48	Scalp	16
One arm (upper and forearm)	45	Abdomen	15
Chest	40	One ear	14
Both feet	38	Both thighs	12
Neck	37	Both knees	11
One leg (thigh and lower leg)	29	Palms of hands	10
One or both eyes	27	One lower leg	10
Both legs (thigh and lower leg)	26	Both lower legs	9
Buttocks	23	Both upper arms	3
Both ankles	23		

Table 3 gives information as to the parts of the body affected, listed in the order of their frequency. We have record of a total of 1,183 burned regions listed, accounting for an average of over 3 such areas per patient. Attention is called to the large numbers of patients with burns of the face, hands and ears. To state the point in another way, of the 360 patients there were only 69 that did not have any burns involving the face, hands, or ears. Let it be kept in mind that burns of the face, hands, and ears should not be treated with tannic acid. Yet it appears in table 4 that 122 patients had been treated with tannic

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acid alone. This is likewise true of the majority of the 128 patien in whom we failed to record the exact nature of the primary trea ment given before their admission to this ship.

TABLE 4.—*Primary local treatment applied to patients before admission to thi ship*

Method	Number of cases	Method	Numb of cas
Tannic acid alone	122	Primary treatment not recorded	1
Sulfonamides	56		
Triple dye	39	Total	3
Paraffin-wax	15		

The contemplation of so high a percentage of flash burns involv ing the exposed surfaces of the body again prompts an expression o opinion that many of these could have been avoided. There wer fewer burns of the trunk and upper arms in our group of patients tha in the Pearl Harbor casualties, because the men have been taugh to wear in battle undershirt and shirt or jumper with long sleeve But a much greater preventive effort to protect face and hands shoul be made. Obviously, many men could wear neither gloves nor anti flash gear to protect the face without impairing their efficiency. Bu some could and should. All men could have gloves at hand, if not t protect themselves, then at times to help others. The lives of severa of our patients were saved because those at hand had on leather glove with which they beat out the flames of burning clothing. Antiflas gear has been introduced to a greater extent on carriers than on othe ships, because of the greater fire hazard on those vessels. (Over ⅓ o our patients came from carriers.) But in a number of instances th antiflash gear became an added hazard when it caught fire, because i had not been adequately fireproofed.

There is yet another circumstance that influences the type of primar local treatment for a given patient, such as the presence of other lesion that themselves require local surgical treatment. The facts appea in table 5.

TABLE 5.—*Coexisting surgical lesions in 360 patients with burns*

Lesion	Number of cases	Lesion	Numbe of case
Wounds: Gunshot or shrapnel	52	Contusions	
Wounds: Lacerated	11	Amputations	
Wounds: Multiple extreme	3	Abdominal wounds	
Fractures, simple	14	One or more of the above lesions	7
Fractures, compound	7		

From these figures it becomes obvious that one cannot adapt, with- out modification, the experiences of civilian practice in the local treatment of burns to cases that are usually encountered in naval

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warfare. The outstanding points are the lack of suitability of tannic acid, triple dye, paraffin-wax, and similar coagulant dressings in the majority of patients and in the majority of individual burns. At the same time it is easily understood that the local use of sulfathiazole as practiced by us is feasible in practically every type of case we have encountered and under the conditions in which we had to work.

As pointed out previously, the severity of the burn was yet another factor which made treatment with sulfathiazole in certain cases preferable to other measures. However, it was not feasible to tabulate in exact percentages the areas involved nor the degrees of depth of the burns for all of our cases.

TABLE 6.—*Time of admission of 360 burn cases to this ship*

	Number of cases		Number of cases
During first 24 hours	33	During 8th to 14th days	56
During 2nd to 7th days	232	After 14th day	39

Table 6 tells at what stage the various patients were admitted. It is seen that the great majority had passed the early stage of shock. Thirty-two had received plasma before being admitted to the ship. Fifteen others were given plasma after their admission, and in total amounts ranging from 500 to 3,000 cc. Eleven patients subsequently required one or more transfusions. The lowest hemoglobin level, observed in a patient who repeatedly vomited blood (Curling's ulcer?) and who eventually recovered, was 36 percent.

TABLE 7.—*Other clinical and laboratory data noted in 360 cases*

Findings	Times noted	Findings	Times noted
Fever	180	Furuncles and abscesses	6
Leukocytosis	100	Hematemesis	3
Renal damage:		Bronchopneumonia	2
Albuminuria	45	Edema beyond tight eschar	1
Elevated nonprotein nitrogen	4	Malaria	1
Anuria	1		

In table 7 are listed various clinical and laboratory findings. Half of the patients at some time had fever.

Of 160 patients in whom leukocytes were counted, 100 showed counts over 10,000. The presence of a marked leukocytosis was noted in 7 patients, the highest being 26,000; 27,000; 35,500; 36,700; 45,700; and 80,000. Of these 7 patients, 1 died; his count was 45,700. The highest count was observed in a Negro patient with flash burns involving about 40 percent of his body surface and treated with tannic acid. When the

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burn areas became infected his blood picture rapidly changed to a simulated leukemoid state, reaching its maximum 10 days after injury. He made a complete recovery. The figures are given in table 8.

TABLE 8.—*Leukemoid response to extensive burns sustained May 8, 1942*

Date	Hb percent	WBC count	Differential count						
			Myelocytes	Juvenile	Band	Seg.	Lymph.	Mono.	Eosin.
5-15	97	13,150	0	0	6	69	13	10	2
5-17	91	24,300							
5-18	84	80,000	2	3	20	53	12	8	2
5-21	84	45,400	3	15	23	45	14	0	0
5-23		22,500	0	2	12	67	15	4	0
5-27		10,150	0	0	3	61	31	4	1
6-4	84	6,500	0	0	1	53	46	0	0

TABLE 9.—*Burn mortality statistics*

Total of patients	360
Died on board of burns (toxemia, shock, early sepsis)	1
Died on board of multiple wounds and burns (shock)	1
Died after transfer, of wound and burns (sepsis)	1

The clinical data of the three deaths listed in table 9 are set forth in the following case histories.

CASE REPORTS

Case 1.—An electrician's mate, third class, 23 years of age, suffered burns of the face, neck, most of his back, both hands, forearms, half of the upper arms and the lower part of the left leg when a bomb struck a gasoline barge which he was loading. He was given emergency treatment consisting of morphine and intravenous plasma, local treatment with tannic acid to the burns, and was evacuated the same day by plane to a naval medical facility. There more plasma was given, but nothing further was done in the way of local treatment. Several days later he was admitted to this ship, obviously in a serious condition. The burns, which were estimated to cover about 35 percent of the body area, were quite deep, third- or fourth-degree in most places, and obviously infected under a macerated tannic-acid eschar that in half the area on arms and face had become separated from the burn beneath. The exposed surface of the burns was covered everywhere with necrotic tissue, and in several spots on the face was bleeding. The hands, arms, foot, and back were grossly edematous. The skin and mucous membranes were jaundiced. The temperature was 100.4° F. and the pulse was weak and thready at 120. He drank water freely but vomited it all at frequent intervals.

A blood count showed 6,140,000 erythrocytes, 117 percent hemoglobin, 45,700 leukocytes, and a differential count with a marked shift to the left. The scant urine showed albumin, granular casts, and many red blood cells.

Treatment consisted in giving intravenous fluids, of which during the night he received 2,000 cc. plasma, 500 cc. 5-percent dextrose solution, and 1,000 cc. physiologic saline solution. The burns on the arms and face were sprayed with sulfathiazole powder and covered with wet saline dressings, held in place on the arms by pressure bandages.

The patient's condition was apparently a combination of shock, sepsis, renal

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and hepatic damage with toxemia. Twelve hours after admission the hemoglobin had dropped to 104 percent, but his general condition showed no improvement. He gradually fell into a stupor and died 7 days after injury.

An autopsy performed 3 hours after death, revealed the chief important findings to be in the liver and kidneys.

The liver was only slightly enlarged, but on section the parenchyma was decidedly bile-stained and the serous surfaces and intimas of the arteries were yellow. The lobules were distinct and enlarged; the centers dark red. The gallbladder and biliary tract were normal. Microscopically, the central areas of all the liver lobules were necrotic and replaced by hemorrhages and mononuclear phagocytes containing bile pigment. The cells of the midzonal and periportal areas were markedly swollen and vacuolated. Many of the nuclei were pale-staining. Many bile canaliculi and smaller bile ducts were distended with bile. The pathologic diagnosis was marked central lobular necrosis.

The kidneys were not enlarged. The external surfaces were smooth and the capsules stripped easily. On section, the cortices were swollen and the striae were indistinct. The parenchyma was uniformly bloody. In two or three minor calices were fresh blood clots adhering to the mucosa. Microscopically, the endothelial cells of the glomeruli were swollen and the lumina of the capillaries were narrow, many being bloodless. The epithelial cells of the convoluted tubules were all swollen so that the lumina were obliterated. Large colloid droplets were numerous in the cytoplasm. The nuclei were either pale and swollen or pyknotic. Many had disappeared. Some of the collecting ducts contained bile-stained casts. The pathologic diagnosis was acute glomerulonephritis.

The heart, lungs, and gastro-intestinal tract were normal, except for the lower end of the esophagus which showed microscopic evidence of acute ulceration. The pancreas and adrenals showed cloudy swelling on microscopic section.

In retrospect, the following comments on the management of this patient seem justified: The depth of the burns made it a foregone conclusion that sloughing and infection would occur under a tannic-acid eschar. The distribution of the burns (face, hands) called for another type of treatment for those regions. The autopsy findings suggest, too, that tannic acid absorption may have played a part in producing the central lobular necrosis of the liver. At the second medical facility a change should have been made to a type of local treatment suitable for the management of an infected burn. Under normal conditions this patient would not have been subjected to the second transfer, a transfer that brought him to us in a state of shock. Military necessity, however, required the additional transfer.

Case 2.—A first lieutenant, USA, was in a plane that crashed while taking off. The patient sustained numerous cuts and bruises about the face, scalp, body, and left wrist, and a large compound comminuted fracture of both bones of the left leg. There were burns involving the face, back, buttocks, and posterior aspect of the right thigh and leg, an involvement of perhaps 30 percent. The burns were, however, largely first-degree. He was taken to a nearby medical facility where he received emergency treatment, including morphine, plasma, and a splint for his leg. No local treatment was given to the burned areas, since they seemed superficial and not of major import. The shock was thought to be due to his injuries. On the afternoon of the next day when he seemed to have rallied from his shock, he was transferred to this ship.

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On the quarterdeck it was obvious that the patient was semistuporous, pulse less, and in profound shock. The blood pressure was 80 systolic and 30 diastolic The hemoglobin was 74 percent. He was at once given 500 cc. of plasma while arrangements were made for a transfusion of 500 cc. of whole blood, given immediately thereafter. He rallied a little, the blood pressure rising to 100 systolic, 40 diastolic, but he did not become conscious. Signs of shock increased and he died the next afternoon, 10 hours after admission.

An autopsy was performed 10 hours after death. The only positive finding aside from the obvious external injuries were a fracture of the eighth right costal cartilage and small fresh hemorrhages in the pons, lungs, and spleen. The liver and adrenals were normal on gross and microscopic examination. There was a congenital horseshoe kidney, the histologic picture of which was normal.

This patient undoubtedly died of shock, in the production of which several factors were operative. In our opinion the chief cause of the shock was the multiple injuries, notably the compound fracture and attendant bleeding. The burns, while contributory to the shock, were less extensive and less severe than those of patients with burns and who developed little or no shock in consequence. Under ordinary conditions this patient would never have been moved while in a state of such obvious shock. Certainly it hardly seems fair to attribute this death to a failure of the treatment for burns.

Case 3.—A seaman, first class, 23 years of age, was injured on board a cruiser receiving first-degree and second-degree flash burns involving his face, throat back, hands, and patchy areas on the chest, abdomen, and legs, aggregating 45 to 50 percent of the body area. In addition there was a shrapnel wound at the base of the neck, with a wound of entrance above the inner end of the right clavicle and a palpable foreign body just behind the lower attachment of the left sternocleidomastoid muscle. After some 5 hours in the water he was picked up by a destroyer and later transferred to a transport 14 hours after injury. The early treatment consisted in morphine as needed, heat cradle, 1,000 cc. of plasma intravenously, debridement of the burn areas and application of tannic acid, and sulfathiazole by mouth. Four days later, there was obvious infection under the tannic acid eschar on the back. The loosened areas of eschar were cut away, and the surface treated with sulfanilamide powder and gentian violet, and covered with sterile pieces of cellophane. The patient's condition continued to be good during this time and was satisfactory when he was transferred to this ship the next day.

On his admission here, there was no evidence of shock. The temperature did not exceed 100, the pulse was in the 80's and the respirations normal. The burns on the back and on both hands were obviously infected. The blood count showed 4,590,000 erythrocytes, 97 percent hemoglobin, and 22,100 leukocytes. The urine contained considerable albumin and some casts. An x-ray film showed a piece of shrapnel, about 1 by 3 by 6 cm., above the left clavicle.

He was given morphine for pain and sulfathiazole by mouth because of the threat of sepsis, both from the burns and the neck wound. The local treatment of the burns consisted in simple cleansing and the application of sulfathiazole powder and wet dressings in the areas where the tannic-acid eschar had separated and been removed.

On the following day, the patient's general condition being good, the piece of shrapnel was removed under local anesthesia from a large necrotic area that extended behind the clavicle and he was given 500 cc. of plasma. His condition continued to be satisfactory, with good fluid intake and urinary out-

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put (the latter showing less albumin), except for the extensive infection in the burn areas and an increasing anemia (75 percent hemoglobin). He received a transfusion of 500 cc. on the 4th postoperative day. His temperature, pulse, and respirations were within normal limits on the next day when he was transferred to a hospital ashore.

Ashore, at the insistence of a friend he was transferred to a civilian hospital in order that he might be treated in a continuous saline bath. He grew rapidly worse, with increasing signs of sepsis to which he succumbed 3 days later. No autopsy was performed.

Of the three fatalities, it is pointed out that only one (case 1) was attributable to the effects of burns alone. Of the other two, one was certainly the result of shock caused by his injuries, not his burns (case 2), and in the other, the fatal sepsis may as well have been caused by the neck wound as by the burns.

The eyes and burns.—Attention to the eyes is a routine part of the primary treatment of burns. It is the custom on this ship for the chief of the eye service to examine the eyes of all burn patients as soon after admission as possible and to prescribe such local measures as he may think indicated. Burns of the eyelids are about as frequent as those of the face—a few over 200 among our 360 patients. In the early stages these may be troublesome because of edema; later, because of crust formation over third-degree burns. Wet compresses with boric acid solution or physiologic saline will hasten the absorption of edema, will help clear up infection, and will soften crusts so that they can be removed. In the latter cases, after the removal of the crusts, microcrystalline sulfathiazole powder can be blown on the closed lids and wet compresses superimposed. Under no circumstances should tannic acid or paraffin-wax be used on the eyelids. Burns of the cornea and conjunctiva are comparatively rare (one or both eyes in 27 of 360 patients) because of the effective protection afforded by the wink reflex. Consequently most corneal and conjunctival burns are found in those who were unconscious when burned. Even then the corneal lesions will probably be below the mid-pupillary area. In these patients the first treatment has been the introduction of 1:4,000 merthiolate ointment or 2-percent butyn ophthalmic ointment into the conjunctival sac on admission and daily thereafter as indicated. Lesser degrees of conjunctivitis at times develop in patients whose face burns become infected. The management of the lesions of the eyeballs is under ordinary circumstances the same as that of corneal ulceration and acute conjunctivitis.

Fractures and burns.—Simple fractures may be immobilized with plaster applied over burned skin that has been dressed with sulfathiazole ointment. Such cases have done very well from the standpoint of the burns, since the continued effect of pressure and immobilization prevented excessive edema and favored healing. It also prevented too frequent and unnecessary change of dressings and so lessened the likelihood of infection. Immobilization of compound fractures with

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plaster is also in order, subject to such modifications at the site of the wound as the particular case may demand. In case of much drainage from wound or burn, a window in the cast may be needed. In two of our patients, skin-grafting of a burn area was carried out through such a window. Of our 360 burn patients, 14 had simple fractures, and 7 had compound fractures. The immobilization of fractures is of course an important means of preventing additional shock.

Care of the hands and joints.—Patients who have suffered severe burns of the hands and in the region of joints present a particular problem after the burns are healed. As previously mentioned, too much motion too early, that is, before healing has taken place, only delays healing and encourages the growth of excessive granulations in deeper burns. But as soon as healing permits, the joints should be passively and later actively moved. At that time the help of one skilled in physiotherapy is of the greatest value in avoiding contractures of muscles and limitation of movement of joints. The physiotherapist has therefore played an important part in the later management of our burn patients.

It would seem worth while to comment on some of the commoner errors in treatment that were encountered in patients who came into our care. This is not done in any spirit of carping criticism of those who administered the treatment, for often enough the errors were due to the overwhelming pressure of work under which the patients were seen; rather, its purpose is constructive, to help others to be on the alert and avoid the same pitfalls.

In the treatment of shock, too little plasma was used in a number of cases. This occurred oftener in those treated with triple dye, possibly because the recognition of shock and also the finding of a suitable vein for giving plasma are made more difficult by the dye.

In several patients rings on fingers were overlooked before applying a dressing. In some instances the hand was not actually involved in the burn and so the removal of the ring had not been considered necessary. But later, edema of the hand developed and the ring could no longer be removed. It should be an inflexible rule to remove rings, whether they fit tightly or not, if any burn is present on any part of the extremity in question.

Delay in recognizing infection was not uncommon, particularly when the infection developed under tannic-acid eschars in regions hard to get at, such as the back and buttocks, or under thick oily dressings. Such delay at times was responsible for rapid deterioration in the patient's general condition (sepsis).

The use of tannic acid on face, ears, and hands was so frequent and its results so often unfavorable that we repeat our warning against it.

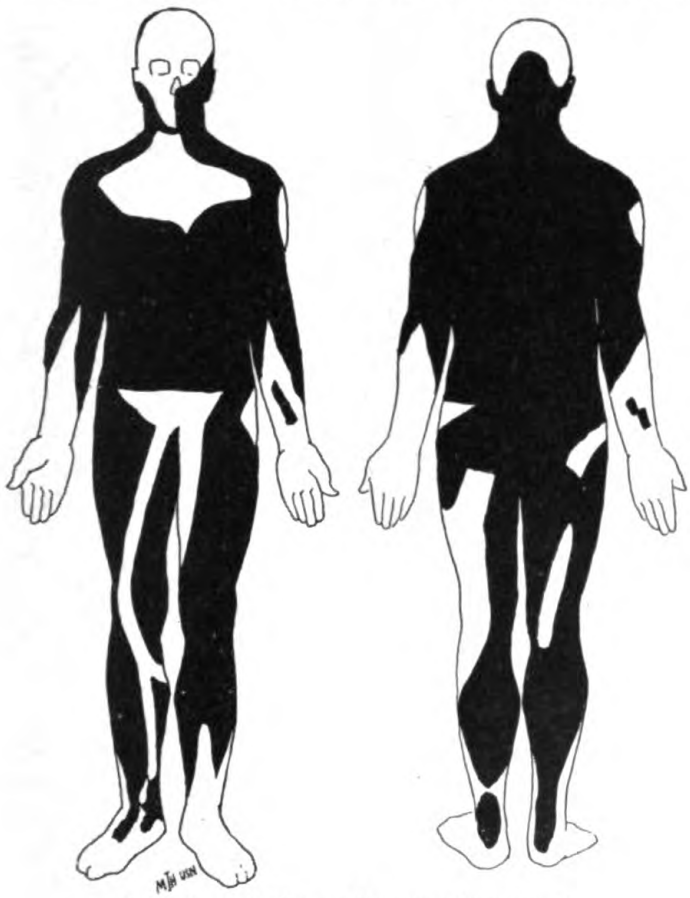
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Failure to record the administration of the booster dose of tetanus toxoid was the commonest oversight. It is safe to say that it occurred in more than half of our cases during a period of considerable activity lasting 3 months.

Additional case reports.—In a series of 360 cases of burns there were many that presented points of great and varied interest. We wish, however, to present only 2 in some detail, because they illustrate a number of practical points in the application and usefulness of the measures proposed in this paper.

CASE REPORTS

Case 4.—A fireman, third class, 19 years of age, was admitted to the medical service with the most extensive burns that we have ever seen to end in recovery;



1. Extent of burned areas in case 4.

an involvement of between 75 and 80 percent of the body surface. He was scaling the inside of a boiler of a light minelayer when steam was accidentally turned on directly across the only opening through which the man could escape. Fully clothed and wearing cap and gloves, he made three attempts to dash through a curtain of steam and boiling water, not succeeding until the third try because he was twice thrown back on coming in contact with an electric fan. He was given half a grain of morphine hypodermically by the hospital corpsman and transferred to this ship, where he arrived about 1½ hours after the accident.

There were first- to third-degree burns, the distribution of which is shown by the shaded areas in figure 1. On the back and regions of the trunk, buttocks and

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upper thighs were areas of third-degree burns. Here two or more layers of clothing had held the heat longest. There were also several burn areas on the genitalia.

He was obviously in shock with a rapid heart rate that by stethoscope was as high as 180, and 152 at the wrist. His blood pressure was 65 systolic and 40 diastolic. A blood pressure reading 12 hours later was 90/35. These were the only readings made because the distribution of the burns made it impossible to apply the cuff without inflicting pain. He was at once given ¼ grain of morphine hypodermically and 3 grains of nembutal by mouth, the clothing was cut away, a heat cradle placed over the body, and 500 cc. of plasma given intravenously. At the same time the cleansing of the wounds was begun. It consisted in cutting the larger blisters, applying sulfathiazole ointment (5-percent strength) on sterile gauze dressings held in place by snugly applied elastic bandages. On the trunk the dressings were held in place by a scultetus binder; the ones over the buttocks were secured by turns of gauze bandage.

TABLE 10.—*Data on case 4*

Date	Hour	Highest of day			Percent Hb.	WBC	Oral fluid (cc.)	Urine			Blood (mg./-100 cc.)				Plasma given (cc.)	Miscellaneous
		T.	P.	R.				cc.	Alb.	Casts	Prot. gm.	Cl.	NPN	Sulf.		
6/8	1430	104.2	180	30	97	29.4	2,500	0	—	—	8.0	659	---	---	500	BP 65/40.
	1930				117										500	500 cc. I. V. saline.
	2200														500	Do.
6/9	0700	104.6	162	20	104		5,300	300	++	+					500	Do.
	1300				97										500	BP 90/35; sulfa.
6/10	0630	104.0	156	24	91	13.8	5,100	?	++	+	6.6	577	82	7.5	---	Crystals in urine.
	1800													5.1	---	Sulf. crystals in urine.
6/11		104.0	120	22	91	12.3	5,200	2,900	++	+					---	Do.
6/12		103.0	122	22	84	10.2	4,500	2,000	+++	+	5.2	412	---	tr.	---	500 cc. transfusion.
6/13		104.6	132	30	78		6,875	1,900	+++	+				0	---	Rational at times.
6/14		105.0	132	26	78		4,700	2,500		+			33		---	
6/15		103.6	130	28	84	8.0	4,000	1,900	+	0	5.8	544	---	---	---	
6/16		102.6	124	28	78		4,200	1,500+	+	+					---	Incontinent.
6/17		101.4	112	28	78		4,500	1,500+	tr	0					---	Toxemia clearing but sepsis threatens.
6/18		100.8	112	30	78		4,400	2,000+							---	
6/19		100.2	120	28	78		3,100	1,000+	0	0					---	
6/20		100.8	120	28	84	15.7	3,200	1,000+	0	0					---	
6/21		101.0	126	30			4,100	2,200							---	
6/22		102.0	120	24	84	17.5	4,000	2,000+	0	0	6.9	---	24	---	---	Blood culture sterile.
6/23		101.6	106	23	84		3,800	2,300							---	
6/24		100.2	120	28	84		3,300	2,400							---	
6 25		100.2	130	26			4,600	2,200							---	
6/26		100.0	120	24	84	14.0	3,800	2,000	0	0	---	---	30	---	---	Blood culture sterile.
6/27		101.0	114	22	---		4,000	3,800							---	Rational from this day on.
6/28		100.2	124	22	---		4,000	2,800							---	Threat of sepsis has passed.
6/30		99.8	120	22	---										---	Ambulatory.
7/6		99.6	120	20	---										---	
7/12		98.6	108	18	---										---	First day of normal temperature.
7/14		98.4	130	18	---										---	BMR+5%.
7/18		98.4	110	18	---										---	Skin grafted this day.
8/10		98.0	88	18	---										---	Wounds practically healed.
8/13		98.0	86	18	---										---	Evacuated this day.

The course of events can best be followed by referring to the figures in the condensed table (table 10). Shock was of first importance. It will be seen that fluid loss from the burned areas was extensive, as shown by a rise of 20 percent in the hemoglobin reading in less than 5 hours in spite of active treatment with intravenous plasma and physiologic saline solution. In the course of the

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first 23 hours he received 2,500 cc. of plasma and 1,500 cc. of saline solution. The saline was used primarily to stimulate renal activity, since for the first 28 hours he was anuric. In addition to the parenteral fluid, there was a good fluid intake by mouth even on the first day, 4 liters being set as a desirable but not immutable limit for subsequent days. During this period the heat cradle was used, but with only 1 or 2 lights which were turned on when the patient complained of cold and which were put out as soon as he felt warm or began to sweat.

The picture of shock improved, as indicated chiefly by the improvement in the pulse rate and the fall of the hemoglobin and serum protein to their normal levels in about 48 hours. The patient's subjective condition likewise improved, but only partly, in that he responded to questioning and spontaneously asked for food and drink. He continued to be desperately ill, but the picture changed from that of shock rather to one of toxemia. There was an anuria and absorption of toxic substances, including sulfathiazole, from the burn areas, a high nonprotein nitrogen (82 mg.) and sulfathiazole (7.5 mg.) levels in the blood, with albumin, casts and sulfathiazole crystals in the urine which began to be excreted after 28 hours.

By the end of a week the evidence of toxemia steadily lessened, nonprotein nitrogen in the blood dropped to 33 mg., albumin and casts disappeared from the urine, pulse rate improved, and periods of clear mentality became more frequent. Undoubtedly the free diuresis and the progression of healing of the burns were chiefly responsible for the lessening of the toxemia, along with a transfusion of whole blood.

But again the patient continued to be critically ill, the picture suggesting sepsis, with irregular fever, a rising leukocyte count, a recurring tendency to delirium, especially at night, and urinary incontinence.

During this period there was increasing infection in some of the deeply burned areas, especially the back and buttocks, due to the combination of oozing serum, pressure of decubitus involving a third-degree burn no matter on which aspect the patient lay, delirium, and urinary incontinence. However, no major blood stream infection developed and there were no serious local infections in the shape of deep-seated abscesses beneath burn areas. Sulfathiazole was the only sulfonamide employed on the burns.

During this period of sepsis, the patient was allowed to sit on the edge of the bed for a few minutes, with increasingly longer periods daily. This change of position had an excellent effect in improved morale, better appetite; it also permitted change of pressure on recumbent areas, particularly the back, which began to heal rapidly. During this period passive motion of all joints was begun and increased daily.

Throughout this time there was the problem of sedation. In the first 24 hours he was given a total of 1⅓ grains of morphine, and during the 7 days that followed he had from 1/12 to ½ grain a day, the individual doses ranging from 1/12 to ⅛ grain. During the periods of toxemia and sepsis it became increasingly clearer that the morphine was having an unfavorable effect, in that after each dose he would be semistuporous for increasingly longer periods when it was hard to get him to take food or drink. A change to bromides and chloral hydrate, with an occasional dose of a barbiturate at night resulted in a prompt response with improvement in periods of sound sleep and rational waking hours.

The diet consisted at first of liquids, including egg albumen; later anything that would tempt his appetite, with emphasis on a high-protein, high-carbo-

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hydrate, low-fat menu. From the start he was given nicotinic acid (25 mg.), cevitamic acid (50 mg.), and thiamine chloride (5 mg.), each twice daily. After the tenth day, iron was given daily. Simple enemas were used every other day when needed.

The dressing of the burns raised a succession of problems. Of least trouble were the extremities; the dressings were not disturbed for 3 days and then only because the report of a blood level of 7.5 mg. suggested the threat of undue absorption of sulfathiazole. They were found in excellent condition and were again covered as before, this time using a 3-percent sulfathiazole ointment. The dressings on the legs were then left in place for 5 days. The burns on the trunk, especially the back, buttocks and upper thighs, however, oozed huge amounts of serum that called for frequent reinforcement of the dressings. By the eighth day there was evident infection of these areas. The dressings were then changed as needed, shreds of sloughing skin were cut away, the surface was irrigated with warm saline solution, microcrystalline sulfathiazole powder was blown on with an atomizer and covered with wet saline dressings. His position was frequently changed to avoid prolonged pressure on any one area.

By the twentieth day the burns all looked healthy and many islands of young epithelium had appeared in most of the severe burn areas. Only over the sacrum, the lower lumbar region and lateral aspects of the thorax were there extensive areas without epithelium. Granulations, however, grew exuberantly. By the twenty-second day the patient was able to be up and about the ward.

On the thirtieth day he was transferred to the surgical service where, under procaine (½ percent) local anesthesia, numerous pinch grafts were placed on the several areas on back and sides, granulations were cauterized with silver nitrate, sulfathiazole powder was blown on, and sterile dressings were applied and held in place by elastic pressure bandages. Four days later the wounds were examined; all grafts had taken and the remaining granulations were clean and flat.

Sixty-six days after admission, the patient, much underweight, was transferred to another vessel for evacuation to the mainland for further convalescence. The largest area uncovered by epithelium was less than 1 inch in diameter. He continued to make good progress and eventually was discharged to duty. When last seen in early 1943, he was in excellent condition and free of contracting scars.

We would be remiss if we did not give credit to the nursing care which this patient received, notably at the hands of the hospital corpsmen who were assigned to this special watch. But for their faithful, efficient, and untiring efforts and their infinite patience, this man would not be alive today.

Case 5.—A fireman, third class, was burned in the same accident as the preceding patient. More fortunate than his companion, he was able to get through the curtain of steam and boiling water on the first attempt. His burns were less extensive and somewhat less severe, involving the back of the neck, both hands, the whole back, buttocks and most of the posterior aspect of thighs and legs—about 40 percent of the body surface. He was given ½ grain of morphine by the pharmacist's mate on his ship and was transferred to the medical service on this ship about 1½ hours after the accident.

The patient's general condition was remarkably good, considering the extent and depth of his burns. There was no evidence of shock, so that his burns

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immediately were given local treatment. The hands and lower forearms were almost completely involved. After removal of blisters, these parts were covered with sulfathiazole ointment, 5-percent strength, the fingers in a slightly flexed position, the thumb slightly flexed and in opposition to the fingers, with gauze separating the digits and a wad of the same material filling the palm. An elastic pressure bandage was then snugly applied nearly to the elbow. Since the anterior body surface was not involved, he was put face down, and similar dressings were applied to the burn areas on back and legs, with a scultetus binder on the trunk and elastic bandages on the legs. A heat cradle with one light was placed over the patient.

TABLE 11.—*Data on case 5*

Date	Hour	Highest of day			Percent Hb.	WBC	Oral fluid (cc.)	Urine			Blood (mg./-100 cc.)				Plasma given (cc.)	Miscellaneous data
		T.	P.	R.				cc.	Alb.	Casts	Prot. gm.	Cl.	NPN	Sulf.		
6/8	1630	101	120	30	91	13.5	2900	400	0	0	8.6	694	----	---	500	
	1930				97											
6/9	0700	102.4	126	30	104	-----	4150	1250	------	--	---	---	----	---	500	Bp 120/80.
	1300				97											
6/10	------	102.2	120	20	91	15.1	4550	1275	+	0	8.0	---	40.5	1.8	---	
6/11	------	102.2	122	24	---	-----	3950	1925	+	0	---	---	----	---	---	
6/12	------	102.0	108	22	84	9.5	4775	2280	+	0	5.8	462	----	0	---	
6/13	------	103.0	108	28	78	-----	3920	2920	0	0	---	---	----	---	---	
6/14	------	102.0	100	24	---	-----	4100	1480	------	--	---	---	----	---	---	
6/15	------	101.0	94	24	84	11.0	3380	1050	0	0	7.2	---	----	---	---	Out of bed.
6/16	------	101.2	94	22	84	-----	2520	1560	0	0	---	---	----	---	---	
6/17	------	102.2	96	20	---	-----	3840	2150	------	--	---	---	----	---	---	
6/18	------	99.6	92	20	91	-----	2860	1100	------	--	---	---	----	---	---	
6/19	------	99.6	100	20	---	-----	------	-------	0	0	---	---	----	---	---	
6/20	------	99.8	118	18	---	-----	------	-------	------	--	---	---	----	---	---	
6/21	------	99.2	86	20	---	-----	------	-------	------	--	---	---	----	---	---	
6/22	------	98.2	86	20	---	-----	------	-------	------	--	---	---	----	---	---	
7/7	------	[1] 98.0	[1] 74	[1] 18	---	-----	------	-------	------	--	---	---	----	---	---	Discharged to duty, well.

[1] Normal thereafter.

Three hours later, a rapid pulse confirmed by a rise in hemoglobin level gave warning of approaching shock. The data are recorded in table 11. Five hundred cc. of plasma were given, and repeated 9 hours later when the hemoglobin had shown a further rise. Thereafter the signs of shock cleared up, and the patient's condition rapidly improved. There was only a mild stage of toxemia as shown by a transient albuminuria.

The points of chief interest in this case are the absence of any notable degree of infection of the burn areas and the almost complete healing of the hands and right foot apparent when the dressings were removed for the first time on the eleventh day, there being only one unhealed area, the size of a nickel, on the dorsum of the foot. The burn areas on the back and buttocks healed more slowly and were treated with sulfathiazole powder and wet saline dressings. By the seventeenth day all burns were healed. It is noteworthy that this patient was out of bed for short intervals 1 week after the accident, although he still had considerable fever. After 29 sick days he was discharged to duty, well.

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Organization and preparation for handling burn casualties.—In war at sea, burn casualties are numerous. Therefore preparedness to handle many such cases on a moment's notice is a prime responsibility of every naval medical officer. Certain measures along these lines that have proved helpful in our experience would seem worthy of emphasis at this point.

In the first place, on this hospital ship, burn patients are admitted on the medical service, unless they present an obvious major surgical complication such as an unreduced fracture or a large wound. Normally there is a balanced staff on the two principal services, but after a naval battle nearly all admissions are of a surgical nature so that the surgical staff is overwhelmed with cases requiring operative measures. Thus, after one naval engagement we received 366 patients, of whom only 33 had medical conditions. But there were over 50 cases of uncomplicated burns. Under these conditions a large number of burn cases would swamp the resources of personnel and material in the surgical wards; and, in fact, their care did take most of the time of the medical service. Moreover, burn cases present problems of a systemic and physiologic nature that fit well into the province of internal medicine, and the local treatment makes no demands on manual skill beyond that of any internist.

We strongly recommend admitting all uncomplicated burn cases to the *medical* services of hospital ships and naval hospital facilities in advanced areas ashore such as mobile units, or field or evacuation hospitals, or even base hospitals. What is more, this should be the inflexible rule at all times, not only after battle. In the lulls between actions, and especially before the first major action, there might be pressure exerted by the surgeons to have such cases admitted on their inactive service. But there should be no compromise, for the few burn admissions to the medical service at such times are a constant stimulus to maintain supplies, and give the opportunity to train personnel.

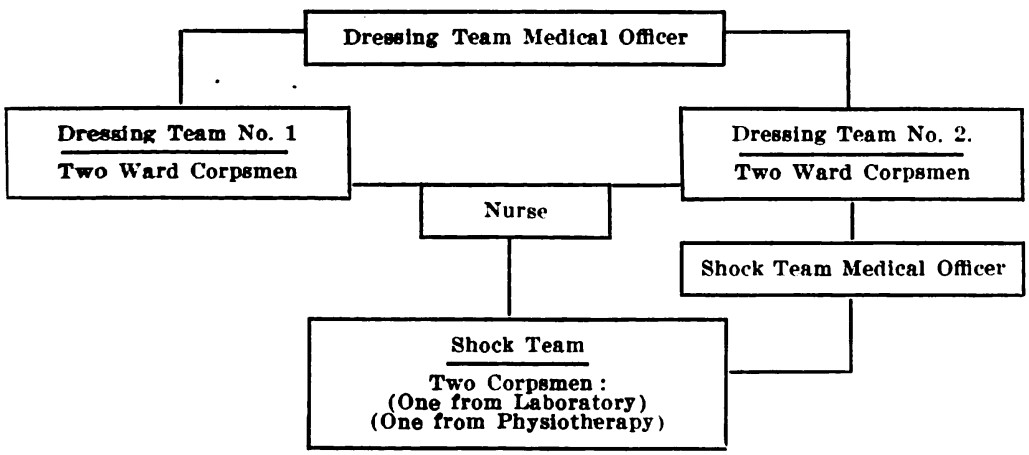
Supplies for treating burns.—Without specifying quantities, since these would depend on the nature and mission of a ship as well as the size of its crew, we here record items which we have found it wise to have available:

Gauze masks. To be worn by all who handle burned patients during dressings
Sterile gloves.
Sterile gowns.
Bandage scissors. To remove clothing.
Sterile cotton waste. Put up in fairly large bags.
Mineral oil, pint bottles.
Sterile physiologic saline solution. For irrigating burns and for wet dressings.
Sterile irrigating syringes.
Sulfathiazole ointment; 3 percent, in a water-soluble base. Put up in 1- or 2-pound jars.

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Sulfathiazole, microcrystalline powder.
Blowers, powder, with rubber bulb. Atomizers also serve well.
Sterile wooden tongue blades. Useful for applying ointment.
Butyn ophthalmic ointment. 2 percent.
Sterile gauze dressings. 4 by 8 inches most generally useful, but 6 inches by 12 inches and a few 12 inches by 12 inches are desirable.
Bandages, gauze. 3-inch.
Bandages, elastic. 3-inch.
Safety pins.
Scultetus binders.
Metal trays. Of suitable size to hold sterile scissors and forceps.
Intravenous trays. Local anesthetic, syringe, ligatures, scalpel and other instruments necessary in case a vein must be exposed to give plasma.
Sternal puncture needles.
Pus basins.
Portable wooden trays. To carry dressing materials from patient to patient. For each team we have such a tray: A simple wooden box 18 by 24 inches with 4-inch sides, and provided with a horizontal straight wooden handle 26 inches long that extends between two flat uprights 15 inches high and attached at the middle of the 18-inch sides.
Cutting pliers to remove rings. This calls for a stout instrument with powerful leverage and a narrow beak to reach into the groove where a ring is imbedded in a swollen finger. The care of this instrument as well as its use should be entrusted to one person; in our case it is the dental officer. At times it is impossible to use pliers on a deeply imbedded ring. In such a case our dental officer used a carborundum bur driven by a portable motor taken to the bedside.

Personnel preparedness.—It has been found very helpful to organize the medical and nursing staff on our medical wards in such a way that everyone has his assigned task. Our wards have a capacity of from 34 to 48 bunks. In each the personnel is organized into teams as shown in the diagram:



Each of the two dressing teams consists of two hospital corpsmen normally on duty in the ward. Their duties are:

1. Put on masks over mouth and nose.
2. Transfer patient from stretcher to designated bed or surgical-type bunk.

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3. Remove clothing (use bandage scissors and disturb patient as little as possible).
4. Check fingers for rings and remove; if a tight ring is found, notify dental officer by messenger.
5. Remove fuel oil.
6. Put clean sheet under patient.
7. Cover patient with sheet and blanket.
8. Scrub own hands with soap, water, brush, alcohol.
9. Return to patient, cut off blisters, using sterile scissors and forceps.

The medical officer who is designated as dressing team medical officer supervises and assists in the work of the dressing teams. He applies the sulfathiazole, the dressings and the elastic pressure bandages on extremities and scultetus binders on the trunk. The medical officer designated as shock team medical officer, when not busy with that team, also works with the dressing teams.

The shock team consists of two hospital corpsmen, one of whom is normally attached to the laboratory, is qualified to estimate hemoglobin, and is experienced in intravenous procedures. The second corpsman of the shock team is drawn from an activity that can dispense with his services during the emergency (e. g., physiotherapy). The laboratory corpsman at once makes a hemoglobin estimation and every 6 hours thereafter for the first 24 hours and reports the reading to the shock team medical officer. The shock team medical officer's first duty is to appraise the patient's condition, as mirrored in pulse rate, blood pressure, hemoglobin, etc., and then to decide if and how much plasma is indicated. The shock team procures the plasma units from the laboratory where the laboratory staff are dissolving plasma as called for. If a vein must be exposed, that becomes the duty of the shock team medical officer. The shock team is responsible for the recording of the following data on a linen shipping tag, 3 inches by 6½ inches, tied to the patient's bunk:

1. Hemoglobin percentage and time of the determination.
2. Plasma given; quantity and time of completion.
3. Other intravenous fluids given; kind, amount and time.

The members of the shock team wear masks when working on a patient whose dressing has not been completed.

One of the two nurses on the ward is assigned to burn team duties. She acts as the coordinator between the several teams on the ward, looks after the narcotic and shock treatment tags, and sees to it that the patient's name and rate are properly entered on the tags. She watches the quantity and condition of supplies on the burn dressing trays and replenishes them as needed. She is responsible for the sterilization of instruments as needed. She directs the nursing care and personally attends to the lights in the heat cradle, turning on one or two lights if the patient is chilly or shivering or complains of cold,

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and off again if he is sweating or complains of being too warm. She is in charge of all records. She notifies the ophthalmologist of the admission on the ward of patients with burns of the face.

SUMMARY AND CONCLUSIONS

1. The data and opinions presented in this paper are based on an experience with 360 cases of burns incurred by naval and military personnel in battle or under conditions of active duty both afloat and ashore, and treated by various methods commonly in use.

2. Burns constitute an important group of casualties in naval warfare. Therefore preparedness for treating such cases in large numbers and at a moment's notice is a prime duty of all naval medical officers afloat and in advance medical facilities ashore.

3. Such preparedness must include both a store of supplies and an organized and trained personnel.

4. In order to distribute the working load best, the treatment of burn cases in hospital ships and in field, evacuation, mobile and base hospitals in advanced areas should be assigned to the medical and not to the surgical service. This in no way detracts from the closest cooperation between the services in the management of these cases.

5. Since burn patients die not of their burns, but of shock, toxemia or sepsis, the first step is to prevent when possible or to recognize promptly and treat these several complications.

6. Pressure dressings can prevent to some degree the development of edema as well as reduce an existing edema, and so lessen the occurrence and severity of shock. Particularly is this true in patients with burns of the extremities over which an elastic bandage can easily be applied. The frequency with which the use of elastic pressure bandages is possible is shown by the fact that of 360 burn cases, 333 had some involvement of an extremity.

7. Shock must be treated by adequate amounts of plasma, the dosage being based on frequent hemoglobin determinations.

8. The use of morphine in the relief of pain calls for an initial dose of not over one-half grain, subsequent doses of not over one-fourth grain, and the meticulous recording of each dose given, on a tag attached to the patient.

9. Toxemia is most effectively prevented and met by an adequate, but not excessive, fluid intake (about 4 liters) and salt by mouth, and, if needed, by vein, sufficient to replace salt lost. In the absence of control by blood analysis, 5 to 10 gm. a day are called for.

10. A prime requisite in guarding against infection of burn areas and possible sepsis is the use of an aseptic technic in dressing burn cases, including the masking of attendant personnel.

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11. The preparation of the burn area for the definitive local treatment calls for simple cleansing (mineral oil and sterile cotton waste to remove fuel oil; plain soap and water) and a minimal debridement (cutting away blisters) to avoid further shock.

12. In the interest of simplicity of preparedness and application and of economy of space and materials, the method of local treatment best suited to naval conditions is one that is applicable to all parts of the body, to patients with coexisting surgical lesions such as wounds and fractures, and both in the primary treatment of an uninfected burn and in the secondary treatment of a burn that has become infected or one that requires preparation for and treatment after skin-grafting.

13. A number of current methods of local treatment do not fulfil 1 or more of these conditions. We would particularly mention tannic acid, paraffin-wax and triple dye. Tannic acid must not be used on face, ears, or hands. Yet of 360 patients only 69 had burns that did not involve these parts. None of the 3 methods mentioned is applicable to an infected burn or in the preparation for or after-treatment of skin-grafting, or to a patient with wounds or fractures.

14. Sulfathiazole, either in 3-percent ointment with a water-soluble base or as a dusting powder, preferably in the microcrystalline form, with wet saline dressings, meets all of these requirements when used in the manner set forth in this communication.

15. Skin-grafting should be done early to prevent scar formation.

16. Many burns could be prevented in naval actions by attention to: Full clothing at battle stations; the use of antiflash gear that has been fireproofed; and by the constant availability of gloves, worn by those whose efficiency would not be reduced thereby, carried by the rest for possible use in case of fire or sliding down ropes, since burns of the hands are responsible for the longest periods of disability.

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RELIEF OF INTRACTABLE PAIN

Bates and Judovich in an attempt to relieve intractable pain, have administered 3,000 injections of ammonium-salt preparations by the paravertebral route and by local infiltration. Starting with an extract of the pitcher plant (Sarracenia purpurea), the active principle of which they concluded was the ammonium ion, they now use ammonium sulfate. At present they inject it subarachnoidally in an attempt to control all types of intractable somatic pain. At the time of injection, severe pain is experienced in the area supplied by nerves bathed by this solution. This can be eliminated, they state, by preceding the injection with 50 mg. of procaine hydrochloride, which provides a short period of spinal anesthesia.—Nicholson, M. J.: Regional anesthesia. New England J. Med. 229: 244–250, August 5, 1943.

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SULFONAMIDES IN BRONCHIECTASIS

A number of patients with bronchiectasis have been treated by the inhalation of a nebulized solution of sodium sulfathiazole. In the first patient so treated oral administration of sulfonamides over a period of months had failed to control the acute infection or lessen the toxic symptoms.

The use of nebulized sodium sulfathiazole solution in a small series of cases of bronchiectasis has resulted in distinct benefits. The first three cases reported were suffering from acute infections and in these the improvement was rapid and dramatic. No systemic reactions were noted and no untoward local effects resulted from the treatment.

Sulfathiazole may be applied locally to the tracheobronchial tree by inhalation of nebulized solutions of its sodium salt. Such treatments are entirely free from local irritation and the amount of the drug absorbed systemically is too small to be measurable.

Sulfadiazine is the drug of choice for systemic use in infections of the lung and bronchi, while for local use experiments indicate that sulfathiazole is best.

Nebulization of drugs in solution is an easy and therapeutically effective form of treatment. A convenient method for the nebulization of drugs in solution is described. While not original, this method has in the past been reserved almost entirely for the use of bronchodilator solutions in asthmatic patients.—Stacey, J. W.: The inhalation of nebulized solutions of sulfonamides in the treatment of bronchiectasis. Dis. of Chest 9: 302–306, July–August 1943.

MAN

Man is still the world's most miraculous mechanism. In 70 years of life, a human being eats 1,400 times his body weight, over 100 tons of food, and he spends 5 full years putting food in his mouth. If his weight is average, every day of his life his heart beats 103,680 times, his blood travels 168,000,000 miles, he breathes 23,040 times, he inhales 438 cubic feet of air, gives off 85° F. of heat and moves 750 major muscles; his nails grow 0.000046 inches, his hair 0.01714 inches—and he utters 4,800 words. The average person blinks 25 times a minute and scientists say each blink takes one-fifth of a second. Thus, if he averages 40 miles an hour on a 10-hour motoring trip, he would drive over 25 miles with his eyes shut. The body can take a lot of punishment and still keep on functioning. Man can get along fairly well, apparently, without his gallbladder, spleen, appendix, and bladder. He can dispense with 1 kidney, 2 quarts of blood, ½ his brain, and all his teeth and still live. And when he dies, he does not die all at once. The brain survives 10 minutes; eyes, 30 minutes, ears, 1 hour; blood molecules, 18 hours; bones, 3 days and skin, 5 days.—Keith, J. H.: Man. Ill. Dent. J. January 1943.

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SIGNIFICANCE OF JOINT PAIN IN YOUNG ADULTS

JOHN W. MARTIN, JR.
Lieutenant (MC) U. S. N. R.

In order to obtain a better understanding of the significance of joint pain in young naval recruits a survey has been made of all cases admitted to this hospital with such complaint between 15 January and 15 April 1943. During this period 106 young men were seen with diagnoses including myositis, bursitis, and arthritis, as well as rheumatic fever. All were white males between the ages of 17 and 24 years, in preliminary naval training. All had passed normal physical examinations not more than 3 months prior to admission. With the exception of 5, all were examined and studied by the writer.

On admission, in addition to the usual laboratory work, sedimentation rates and cardiograms were taken. The sedimentation rates were checked once a week. Cardiograms were taken on the average of three to four times during the hospital stay. An examination of the heart was made at frequent intervals. All murmurs were graded from one to four plus according to their intensity. None were listed unless heard on at least two separate examinations. Before discharge patients were fluoroscoped in both posterior-anterior and oblique positions. By the use of thick barium by mouth the left auricle was outlined by the esophagus.

Although it is generally admitted that rheumatic fever is the most frequent cause of joint pain in this particular age group, the high incidence in this series was surprising. Out of 106 patients complaining of painful joints, rheumatic fever was found to be the cause in 97, or 88 percent. It is perhaps of even greater significance to note that, out of the series of 106 cases, 85 or 80 percent, had definite evidence of cardiac involvement as shown by either the appearance of organic murmurs or by abnormalities in the cardiogram.

In cases in which the diagnosis of carditis was made, there were 46 (54 percent) in which the murmurs appeared with normal cardiograms. In 6 cases (7 percent), there were no murmurs, but a definitely prolonged PR interval. In the remaining 33 instances (39 percent), both murmurs and cardiographic changes were found. It is therefore apparent that the careful repeated examination of the heart is of more importance than the tracings, yet the latter are very useful adjuncts and in some cases, the only abnormalities.

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Murmurs.—A total of 88 organic murmurs was noted in 79 cases. Their distribution is as follows:

Apical systolic or mitral:			
Apical systolic grade-one (faint)	28		
Apical systolic grade-two (moderate)	40	73	83 percent
Apical systolic grade-three (loud)	5		
Apical diastolic		1	1 percent
Aortic systolic		6	7 percent
Aortic diastolic		8	9 percent

The preponderance of the mitral valve lesions is, of course, to be expected. In many instances, patients listed as having grade-two murmurs had come in with normal heart sounds, the valvular pathology manifesting itself only after a period of days or weeks. In a few other cases, murmurs present on admission disappeared entirely. The loudest murmur was always listed when there was a change in intensity. The infrequence of the apical diastolic murmurs is not surprising in view of the recent onset of the condition in most instances.

The percentage of aortic murmurs is in keeping with previous studies. The surprising feature, however, was the fact that 7 out of 8 aortic diastolic murmurs occurred independently of an aortic systolic murmur. Although these diastolic aortic murmurs were quite loud in most of the cases (particularly in the fourth left interspace next to the sternum) there was no change in the diastolic blood pressure.

Cardiographic findings.—In 39 cases (37 percent) of the entire series definite abnormalities were found in the cardiograms. These are as follows:

PR interval greater than 0.2 second (including four cases of heart block)	32	(78 percent of cardiogram abnormalities)
Changes in rhythm (i. e., nodal rhythm) with reversion to normal	5	(12 percent)
Inverted T waves in leads 1, 2, or 4	4	(10 percent)

In addition to the above-noted abnormalities, a large number of cases showed lowered T waves during the acute phase of the infection. As the clinical symptoms subsided the T waves increased in amplitude. This change was independent of the heart rate.

Joints.—The ankles, knees, and wrists were involved most frequently. In a few cases, however, the onset of pain was in the fingers or toes. Several men had been treated for "foot trouble" just prior to admission. In one instance, a patient was admitted because of an acute suprapatellar bursitis, which developed after twisting the knee in running. He gave no previous history of rheumatism, but said that the same knee had been injured seven years before. Heart sounds were normal. Although there was little to suggest a rheumatic infection except a slight elevation in the admission tempera-

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ture, a cardiogram was taken. The true nature of the process was revealed in a PR interval of 0.38 second. Within 10 days, a blowing systolic murmur developed which has persisted. This one case is cited as an example of several with atypical onset which might easily have been missed if a thorough check had not been made.

The joints were usually swollen and hot, but very rarely red. Much of the swelling and tenderness involved periarticular tissues rather than the joint proper. As a rule tenderness subsided in 5 or 6 days' time with salicylates by mouth, but in about a quarter of the cases there was some recurrence of joint symptoms, as a rule less severe than the original attack. No correlation between the severity of the initial joint pain and the degree of cardiac involvement could be demonstrated, but those with repeated exacerbations of the joint symptoms were more apt to develop cardiac signs.

Fluoroscopic examination.—This was of little value, as might have been anticipated, in cases of early rheumatic fever. In only four cases was any enlargement demonstrated. Three of these had pericarditis. The other was the single case of mitral stenosis seen.

SUMMARY

One hundred six cases of joint pain admitted to the hospital in a 3-month period were studied.

Ninety-seven (92 percent) of these were clinically diagnosed as rheumatic fever.

Eighty-five (80 percent) of the total had definite evidence of cardiac damage.

Rheumatic fever must be kept continuously in mind in all cases of joint pain in young adults. It must be considered as the causative factor until definitely ruled out by careful observation and cardiographic studies.



SUMMARY OF EXPERIENCE WITH PENICILLIN ON A SURGICAL SERVICE

Experience with the use of penicillin by members of the surgical staff is summarized: In all, 25 cases were treated. The youngest patient was 4½ years old, the oldest was 30. The organism was the gonococcus in 21 cases, and the staphylococcus in 3. No culture was obtainable in 1 case.

The conditions treated were gonorrheal urethritis, gonorrheal urethritis complicated with arthritis, gonorrheal urethritis complicated with epididymitis, suppurative pleurisy complicated with staphylococcic pneumonia, osteomyelitis of the tibia, osteomyelitis of the femur, and osteomyelitis of the maxilla.

All the cases selected for treatment with penicillin had failed to respond to sulfonamide therapy. Following the use of penicillin,

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every case showed a favorable response. Twenty-one cases of gonorrhea already on the sick list 2 months or more showed negative urethral smears 6 hours after treatment was begun, and the smears remained negative. A child with osteomyelitis of the tibia and temperature of 105° F. became afebrile after 4 days on penicillin, and was discharged from the hospital 6 days later. A patient with suppurative pleurisy and staphylococcic pneumonia, bedridden for months and running a daily fever, showed a favorable response on the 9th day of treatment, the temperature becoming normal and remaining normal. He is now up and about, less than 3 weeks after his first injection of penicillin. A case of advanced osteomyelitis of the maxilla showed cessation of discharge after 48 hours and appeared free from infection after 7 days, a miraculous result.

A patient with osteomyelitis of the femur showed a marked diminution in the amount of discharge within 48 hours after penicillin was started. His temperature which had been rising daily to 103° F. for weeks, dropped to normal after 24 hours and has remained normal. However, although his infectious process is apparently well under control, the patient is still bedridden and in a debilitated condition following his many months of illness.

For the treatment of the 25 cases, 4,300,000 units of penicillin were used. The average total dose in the cases of gonorrhea was 160,000 units in the first 6 cases, and 100,000 units in the remaining 19. The average total dose used in the cases of osteomyelitis was 400,000 units. The case of suppurative pleurisy required 1,100,000 units.

Patients with gonorrhea were given 10,000 units every 3 hours day and night for 48 hours. Twenty thousand units every 3 hours for 5 doses was found equally effective. The cases treated intravenously were at first given the penicillin in 2 doses daily of 50,000 units each, in infusions of 1,000 cc. of normal saline or 5 percent dextrose solution. Later the dose was reduced to 25,000 units twice daily with just as good an effect.

The duration of treatment varied. At first, patients with gonorrhea were treated with penicillin for 48 hours. Subsequently, the treatment was given for only 15 hours with equally good results. All the other conditions treated required penicillin for 6 days or more. One patient received treatment for 16 days.

The mode of administration of the penicillin varied also. The intramuscular route was used in all cases of gonorrhea and in the child with osteomyelitis of the tibia. In the remaining cases, the penicillin was given intravenously. There were no reactions.

The leukocyte count dropped gradually, approaching normal, as treatment progressed. In 2 cases, an increase in the red cell count occurred during treatment. In no case did the blood counts show any evidence of blood destruction, nor did repeated urinalyses show any evidence of renal damage which could be ascribed to the penicillin.

We are most enthusiastic with regard to our results with penicillin. It is remarkable indeed, to have at our disposal an agent so potent in inhibiting bacterial growth, and yet so free from toxic manifestations.—Staff Surgical Conference. U. S. Naval Hospital, San Diego, Calif.

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AIDS TO EVALUATION OF SYSTOLIC HEART MURMURS IN THE SELECTION OF NAVAL PERSONNEL

RALPH C. PARKER, JR.
Lieutenant Commander (MC) U. S. N.
and
BENJAMIN V. WHITE, JR.
Lieutenant (MC) U. S. N. R.

One of the most difficult problems which confronts the naval recruiting officer is the evaluation of apical systolic heart murmurs. For this reason many candidates with borderline murmurs have been referred to the Heart Station at the National Naval Medical Center for diagnostic study. Opportunity has thus been afforded for the evaluation of various diagnostic procedures.

A study of apical systolic heart murmurs is of more than academic interest at the present time because in many instances a "spot" decision is imperative. It is usually not possible to follow the safer and surer policy of re-examining the subject at yearly intervals and reserving a decision until the full quota of signs appear. It may be argued that if men with doubtful lesions, no symptoms, and normal cardiac function are taken into the armed forces they will serve for the duration of the war without difficulty. There is evidence, however, that under the strain of severe activity and prolonged exposure many of them do not stand up well. Furthermore, these men may become a liability long after they are discharged from the service, to be cared for and pensioned by the government.

It is obvious that the decision as to whether a heart murmur is organic or functional is not always easy, and an erroneous judgment may profoundly affect the person's career. Examples of two such instances are pertinent. The first was a 23-year-old man who was discharged from active duty in 1939 because of mitral and aortic valve disease, presumably on a rheumatic basis, although a definite history of rheumatic fever was lacking. Recently he was examined as he wished to re-enter the service. He had apparently been in good health, and the only physical finding was a short, early, blowing systolic murmur at the apex which could not be heard by all the examiners. As the result of the re-examination it was recommended that he be reinstated. The other case was that of a 40-year-old naval officer with no history of rheumatic fever who stated that he had had a "functional" murmur since his days in the Naval Academy. At present he has a loud, screeching, mitral systolic murmur with definite enlargement of his heart. He is being retired at a time when men of his experience are invaluable.

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SELECTION OF MATERIAL.

This study is based largely on the examinations of a group young men seen in consultation at the Heart Station of the Nation Naval Medical Center. All were seen by one or both authors and al by Commander Arthur M. Master (MC) USNR, director of t station. Many of the men were candidates for the service and h been referred to us by recruiting stations and procurement cente A small number of women, and older men already in the service, wi definite valvular disease were studied for purposes of comparison.

In classifying the material, the history was in most cases consider unreliable and little dependence placed on it. The relative infr quency of a history of rheumatic fever or any illness resembling was attributed to conscious or subconscious suppression of this info mation. Many persons do not remember all their childhood diseas and naval candidates are presented with the temptation to minimi them.

Physical examination included examination of the heart by palp tion, percussion and auscultation. The latter was performed in tl standing, sitting, supine, and left lateral positions (*3*), and in a phases of respiration. Each subject was examined before and aft exercise.

The size of the heart, the quality of the heart sounds, and the roug ness and duration of the murmur were the principal criteria by whic this classification was made. These criteria are in general tho established in paragraph 1488 (b) of the Manual of the Medical D partment.[1] Less consideration was given to transmission of the mu mur than to the criteria just enumerated. Thayer (*2*) was of th opinion that many functional murmurs were transmitted from th pulmonic area to the apex. Paul White and Reid (*3*) found that tran mission added little to the examiner's impression. In the prese series most murmurs clearly transmitted to the axilla were considere to be in the organic group, but moderate transmission to other area was considered of no significance. White and Reid emphasized th importance of prolonged murmurs, starting with or masking the fir sound and persisting throughout systole. In this series such murmu were considered to be abnormal even though of faint to moderat intensity. Likewise prolonged murmurs with a screeching "sea gull overtone were considered to be abnormal.

[1] "Loud systolic murmurs, audible at the apex and in the left back, if associated with a enlargement of the heart, with a snapping first sound, or accentuation of the pulmon second sound, indicate organic disease, disqualifying for the service; also harsh and blowi murmurs, and those persisting throughout systole, transmitted to the axilla or back, associated with a history of rheumatic fever, or other acute infection, or with poor dubious response to exercise are disqualifying."

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The entire series was divided into the following groups. The quality and duration of the murmur was in most instances the determining factor.

Group I, *Functional Systolic Murmurs.*—This group was composed largely of candidates who were recommended for unlimited active duty in the Navy. A small number of other persons with similar murmurs were included.

Group II, *Organic Systolic Murmurs.*—This group comprised those candidates whose murmurs were sufficiently harsh or prolonged so that there was a reasonable presumption of organic heart disease (mitral insufficiency), and also a few other persons with similar findings.

Group III, *Mitral Stenosis.*—This group included persons with apical diastolic murmurs characteristic of mitral stenosis.

The interpretation of murmurs is generally a subjective procedure, so that it is important to evaluate other, more objective, methods of examination. The most commonly used methods are x-ray, fluoroscopy and electrocardiography. Tests of cardiovascular function and the recording of heart murmurs are probably used less frequently. In the following paragraphs an attempt is made to evaluate the importance of all these procedures relative to the clinical grouping discussed above.

THE ELECTRICCARDIOGRAM.

Changes in the P wave of the electrocardiogram in mitral stenosis are widely recognized (*4*) (*11*), although their diagnostic specificity has seldom been subjected to critical analysis. For this reason electrocardiographic tracings were made in all the subjects under consideration. The tracings were analyzed with regard to the height of P_2, the width of the widest P wave in any lead, and the number of leads in which deep notching occurred. P waves which showed notching extending one half way to the base line were considered to be deeply notched (*7*). The height of the P wave was measured in lead II because White, Parker, and Master (*11*) had previously demonstrated that this was the most significant lead. Paul White and Bock (*5*) in a study of electrocardiograms at the Massachusetts General Hospital, showed that P waves 3.0 mm. or more in height were almost invariably associated with organic disease, in most instances, mitral stenosis. Recently White, Parker, and Master studied the arithmetical probability of P waves exceeding this height in mitral stenosis, in organic systolic murmurs, in functional systolic murmurs, and in controls. Although confirming the work of earlier investigators on the frequency of tall P waves in mitral stenosis, they found no difference in the heights of the P waves in the other three groups. The percentage

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of P waves in the present series, measuring 3.0 mm. or more in lead II, is shown in table 1. The height of the P wave was found to be of no value in the differentiation between functional and organic systolic murmurs.

TABLE 1.—*Abnormal characteristics of the P wave of the electrocardiogram, expressed as percentage*

Group	Number of cases	Height of P_2 3.0 mm. or more	Widest P wave 0.12 sec. or more	Deep notching in more than 1 lead	1 or more of preceding abnormalities
		Percent	*Percent*	*Percent*	*Percent*
Functional systolic murmurs	100	2	2	4	7
Organic systolic murmurs	43	0	11	5	15
Mitral stenosis	22	23	27	9	50

Note that the anatomical changes in mitral stenosis are reflected in the electrocardiogram. The only abnormality in organic systolic murmurs is increased width of the P wave. This occurs in 11 percent of the cases but is of no diagnostic value.

The width of the widest P wave in any lead was also studied. Although it is commonly stated that P waves over 0.10 sec. in width are abnormal (*6*) (*7*), White, Parker, and Master (*11*) found the arithmetical probability of waves 0.11 sec. wide in their control group to be 25 percent. They, therefore, established the criterion of 0.11 sec. as the upper limit of normal. The fact that their standard was 0.01 sec. wider than that of the other workers was attributed to the fact that they measured the widest P wave in any lead. Individual variations in the widths of the P waves are appreciable. In the present series P waves 0.12 sec. wide occurred in 2 percent of the functional group, 11 percent of the organic systolic murmur group, and in 27 percent of the mitral stenosis group. The difference between the functional and organic systolic murmur groups was so slight that individual determinations were found to be of no diagnostic value (table 1).

Notching of the P waves is a frequent finding, particularly in tracings taken with amplifier instruments designed to cast a thin string shadow. In this study over 50 percent of control tracings showed unmistakable notching in at least one lead. Ashman and Hull (*7*) had already concluded that notching was of no diagnostic importance unless the apex of the notch descended one half way to the base line. White, Parker, and Master found, moreover, that even deeply notched P waves occurred in 6 percent of control tracings. They suggested, therefore, that deep notching should not be considered abnormal unless present in more than one lead. From table 1 it is apparent that notching did occur more frequently in subjects with organic than with functional heart murmurs, but the difference was too slight to be of diagnostic importance.

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When all the criteria of abnormality of the P waves were considered (table 1), 7 percent of subjects with functional systolic murmurs and 15 percent of subjects with organic systolic murmurs showed abnormalities. This compared with 50 percent of abnormalities in the group of subjects with mitral stenosis.

The electrocardiogram frequently reflects the anatomical changes which result from mitral stenosis. In these patients, however, the diagnosis may be readily made in most instances by auscultation alone. In the uncomplicated systolic murmurs on the other hand, the anatomical changes in the heart are so slight that they are not significantly reflected in the electrocardiogram. The electrocardiogram is of no value in distinguishing between functional and organic systolic murmurs.

ROENTGENOLOGIC EXAMINATION.

X-ray examination, particularly fluoroscopy, was very helpful in concluding that a given murmur was or was not significant. Teleroentgenograms were used to make actual measurements of the heart size (*12*) (*13*) (*14*), while fluoroscopy, though more subjective, was employed in visualizing the individual chambers of the heart (*9*) (*15*) (*16*). Measurements of the heart size were made in 46 cases. To estimate the subjective error in determining these measurements, the entire series was read by one observer, after which all marks were removed, and the series similarly studied by a second observer. As a result of this study it was found that there was a coefficient of variation of 7.4 percent in estimating the cardiothoracic ratio and a coefficient of variation of 7.7 percent in estimating cardiac area. To these subjective errors must be added the errors inherent in the methods themselves.

Probably the measurement in most common use is the cardiothoracic ratio. The average is generally considered to be 0.45, while ratios above 0.53 are considered abnormal (*12*). For the purpose of studying mitral valve disease this ratio is of limited value, for in addition to the errors already cited, it is primarily an index of ventricular enlargement. Due to the posterior location of the left auricle (*17*) and also to its small size relative to the heart mass, early or moderate auricular enlargement does not affect the total transverse diameter of the heart. In a series of 500 normal young men Smith and Bloedorn (*13*) found the cardiothoracic ratio varied from 0.36 to 0.57 and that 14 percent of this group had a ratio over 0.53. As a result of this wide range the cardiothoracic ratio was found to be of little use in determining the degree of enlargement usually seen in early mitral valve disease. Josephi (*18*) also found the cardiothoracic ratio to be of little value. In the present series, the cardiothoracic ratio was over 0.50 in only 27 percent of cases of mitral stenosis and in none of the other groups

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The use of the area of the cardiac silhouette is thought to give a better index of enlargement than the cardiothoracic ratio. Theoretically it should do so inasmuch as it is calculated from the long and broad diameters, the latter of which is measured across the "waist" of the heart where enlargement of the left auricular appendage is projected. Moreover, Smith and Bloedorn found that mean cardiac area varied directly with body surface area. Unfortunately, the lower end of the broad diameter is measured from the lower border of the heart shadow, which cannot be traced with any degree of accuracy. This factor largely accounted for the coefficient of variation of 7.7 percent between our two sets of readings of the same series of plates. Smith and Bloedorn discovered, too, that in any given normal individual the cardiac area might differ considerably from the mean. Despite the errors inherent in this method, it was nevertheless more helpful than the cardiothoracic ratio in confirming the presence of structural heart changes. In each instance employing the mean of the areas calculated from the readings of two observers, it was found in the functional group that 22 percent exceeded the predicted area by 10 percent or more, 11 percent exceeded it by 15 percent or more, while none exceeded it by 20 percent. In organic systolic murmurs the figures were almost identical; 23 percent exceeded the predicted area by 10 percent or more, 8 percent exceeded it by 15 percent or more, while none exceeded it by 20 percent. In mitral stenosis, however, 62 percent exceeded the predicted area by 15 percent or more, and 45 percent exceeded it by 20 percent or more.

It seems reasonable to conclude, therefore, that an area over 20 percent greater than the predicted area should strongly suggest enlargement of the heart and afford confirmatory evidence of mitral stenosis or other definite heart disease. Measurement of cardiac area was of no value in distinguishing between functional and organic systolic murmurs. Fluoroscopy, on the other hand, was often helpful. A slight degree of enlargement of the left auricle was frequently seen in a small arc of the left oblique position, although when an attempt was made to reproduce it on the x-ray film, the proper angle was not obtained. An enlarged left auricle was found in 72 percent of cases where mitral stenosis was present, in 43 percent of patients with organic systolic murmurs, and in 5 percent of cases with functional systolic murmurs. The percentage of enlarged left auricles in mitral stenosis is identical with the figure quoted by Cookson (*16*). The left auricle was enlarged more often than the right (table 2).

The relation between auricular enlargement and enlargement of the pulmonary conus was found to conform with the back pressure hypothesis (*17*). It was found that in the mitral stenosis group, when the pulmonary conus was enlarged, auricular enlargement was present in 100 percent of the cases. However, of the total number

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of patients with mitral stenosis and enlarged left auricles, only 47 percent had enlargement of the pulmonary conus. This suggested that the enlargement of the auricle preceded the change in the conus. That enlargement of the conus sometimes occurs in normal individuals (independently of back pressure from the mitral valve) is attested by the incidence of 10 percent of enlarged conuses in the functional murmur group.

In summary, estimation of the cardiothoracic ratio was found to be valueless because of the error inherent in the measurements, the wide variation in normals, and the number of normal ratios in persons with outspoken heart disease. Measurement of the area of the cardiac silhouette was subject to a comparable error in estimation. Although individual variations up to 20 percent from the predicted area were observed (confirming the earlier work of Smith and Bloedorn) the area was still found a better index of cardiac enlargement than the cardiothoracic ratio. It was abnormal in some cases of mitral stenosis but of no value in differentiating functional from organic systolic murmurs.

TABLE 2.—*Fluoroscopic observations in percentage*

Group	No. in series	Any abnormality	Enlargement left auricle	Prominent pulmonary conus	Enlargement right ventricle	Enlargement left ventricle	Enlargement right auricle
		Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Functional systolic murmurs	77	12	5	10	0	0	3
Organic systolic murmurs	35	66	43	14	3	8	11
Mitral stenosis	18	94	72	45	28	39	28

Note that enlargement of the left auricle occurs with significant frequency both in mitral stenosis and in organic systolic murmurs. Prominence of the pulmonary conus is a relatively frequent finding in normal persons.

Fluoroscopy in skilled hands, although more subjective than either of the above determinations, was found to reveal the minor changes in cardiac contour which are anticipated in early disease of the mitral valve.

EXERCISE TOLERANCE.

Eighty-three subjects were studied by means of the "two-step" test (*19*) (*20*). This test consists of walking over a style two steps high. It was devised by Master and Oppenheimer (*19*) and subsequently modified by Master (*20*). The test was considered abnormal with regard to pulse or systolic blood pressure if one or the other respectively failed to return to within 10 points of the resting level at the end of 2 minutes. Master found abnormal responses in persons with labile vasomotor systems, in hypertensive subjects, and in many patients with embarrassed cardiovascular function. This exercise test, like the Crampton index (*21*), Schneider test (*22*) (*23*), Turner test (*24*) (*25*) (*26*) and Behnke test (*27*) is subject to individual

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variations associated with nervous tension, fatigue, convalescence, physical training, and other factors. It cannot in any sense be considered of specific diagnostic value, but it is useful in estimating the vasomotor responses of the candidate.

The test was performed, by the technic outlined by Master, in 40 subjects with functional systolic murmurs, in 25 subjects with organic systolic murmurs, and in 18 patients with mitral stenosis. The results are recorded in table 3. The fact that 15 percent of persons with functional murmurs showed abnormalities of the pulse response and 35 percent showed abnormalities of the blood pressure response is largely to be explained on the basis of the fact that functional murmurs are common in the slender, asthenic, type of person who so often suffers from vasomotor instability. A contributing factor was undoubtedly the fact that, as candidates, these persons were under a considerable degree of nervous tension at the time the tests were performed. The element of nervous tension was undoubtedly absent in the academic atmosphere where the test was originally devised. It is, nevertheless, interesting that in those subjects with organic murmurs and in those with mitral stenosis, the percentage of abnormal responses was roughly doubled.

In addition to the pulse and blood pressure responses to exercise, electrocardiograms were taken at rest, immediately following exercise (*28*) (*29*), and at 2-minute intervals for 10 minutes thereafter. Those electrocardiograms in which the RST segment of any lead became depressed more than 0.5 mm. below the isoelectric line of the P–R interval were interpreted as positive. This is the criterion of abnormality recommended by the originators. The depression of the RST segment following exercise was shown by Master (*30*) to be similar to the change produced following the inhalation of oxygen of low concentration.

Reference to table 3 indicates that the percentage of positive responses was approximately the same in subjects with functional murmurs, subjects with organic systolic murmurs, and patients with mitral stenosis. The RST change is presumably in some way dependent on metabolic processes in the myocardium. Under controlled conditions it is of value in the study of coronary disease. It is of no diagnostic value in the study of endocardial problems.

TABLE 3.—*Responses to the "two-step" test, expressed in percentages*

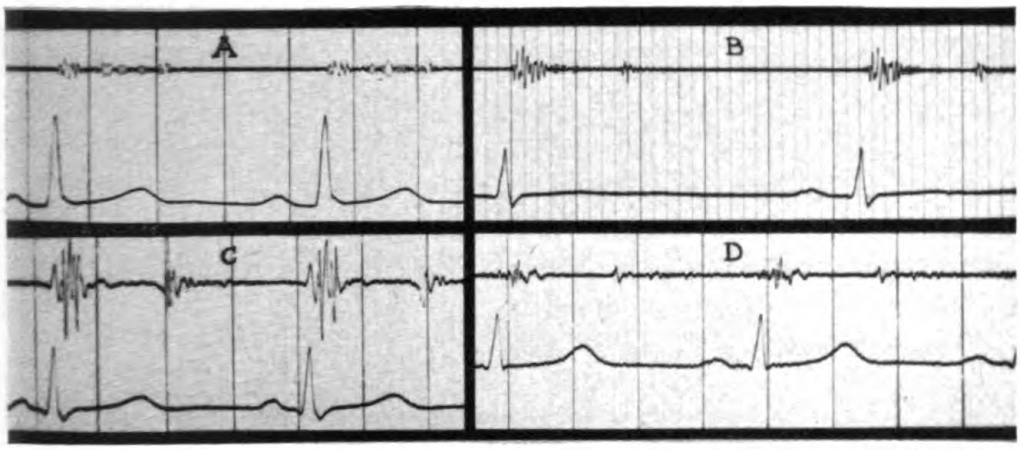
Group	No. of cases	Pulse response abnormal	Blood pressure response abnormal	Electrocardiogram after exercise abnormal
		Percent	*Percent*	*Percent*
Functional systolic murmurs	40	15	35	17
Organic systolic murmurs	25	44	62	25
Mitral stenosis	18	30	78	22

The relatively high number of abnormal pulse and blood pressure responses is attributable in part to the nervous tension under which candidates were when examined.

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SOUND TRACINGS.

In 24 subjects sound tracings were made. In most instances both a logarithmic and a regular microphone were employed and the two tracings compared. The purpose of the logarithmic microphone was to record high-pitched murmurs, which were not adequately registered by the ordinary pick-up. The amplification and recording was accomplished by means of a Sanborn tribeam stethocardiette with which it was possible to record lead II of the electrocardiogram simultaneously with the heart sound tracing. The timing of the heart sounds and murmurs was thus accurately delineated.



1. Sound records. In each specimen the upper tracing is that of the heart sounds; the lower is lead II of the electrocardiogram. **A.** Murmur with "sea gull" overtone persisting throughout systole. **B.** Murmur in first half of systole with early diastolic murmur immediately following the second sound. **C.** Reduplication of first heart sound. **D.** Long diastolic and presystolic murmur which follows the third heart sound.

In some instances the murmurs were satisfactorily recorded and served as objective corroboration of the clinical findings. Such tracings are illustrated in figure 1; **A** representing a prolonged systolic murmur with a "sea gull" overtone and **D** representing a prolonged mid-diastolic and presystolic murmur characteristic of mitral stenosis. It was found particularly difficult to record satisfactorily high-pitched murmurs of low volume even with the logarithmic microphone. For this reason a normal sound tracing could not be relied upon to rule out the presence of a murmur. In fact the diastolic murmurs of patients with aortic insufficiency (not included in the series under discussion) were rarely satisfactorily recorded. In some instances they were recorded, as in figure 1 **B,** however, and in such cases were shown to commence immediately after the second heart sound rather than after the third heart sound as did the diastolic murmurs of mitral stenosis (figure 1 **D**). This confirmed subjective observation based on auscultation (*31*).

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The sound tracing was found to be of diagnostic value in two circumstances. The first was in the evaluation of patients with loud, booming, reduplicated first heart sounds accompanied by a pseudothrill. Under the nervous stress of procurement examinations the overactivity of the heart is frequently accompanied by these findings. If, in addition, the pulmonary second sound and the third heart sound are prominent, the differentiation from mitral stenosis is very difficult. In a case of this sort the accurate timing of the reduplicated first sound is of great importance, and a sound tracing which places all the vibrations in systole is reassuring, especially when roentgenologic evidence of a normal size heart is available. Such a tracing is illustrated in figure 1 **C.**

The second circumstance in which the sound tracing was found to be of specific value was in the recording of murmurs throughout systole. Most functional murmurs tend to appear in only a part of systole (*3*), while most murmurs which mask the first sound or commence with it and then persist throughout the full phase of systole are considered to be organic. A prolonged murmur lasting throughout systole is illustrated in figure 1 **A.** A short murmur in early systole (although in this case associated with definite heart disease, aortic insufficiency) is illustrated in figure 1 **B.** Such a systolic murmur is often seen in otherwise normal persons and is considered to be functional.

DISCUSSION

The evidence indicates, as has been pointed out by other authors, that in the presence of mitral stenosis certain roentgenologic and electrocardiographic abnormalities frequently occur. The percentage is not sufficiently high, nor are the changes sufficiently specific, to constitute a basis for diagnosis to the exclusion of auscultation. On the other hand, these changes, when considered as a part of the entire clinical picture, are frequently helpful.

In regard to the more difficult problem of differentiating between functional apical systolic murmurs and "mitral insufficiency" the electrocardiograph was found to be of no value. Exercise tolerance tests were likewise of no value.

In contrast to these studies, however, x-ray was decidedly useful, particularly the fluoroscopic examination. This procedure is, unfortunately, subjective, but inasmuch as the subjects were studied under the direct observation of a trained cardiologist, it is felt that the results are significant. The pathologic physiology of mitral stenosis is entirely consistent with an enlarged left auricle. The relation between left auricular enlargement and the less clearly delineated condition of "mitral insufficiency" is more tenuous. It is possible that in each case where only an organic systolic murmur is

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demonstrated, a degree of stenosis sufficient to affect the auricle may exist although an audible diastolic murmur may not be present at the time of the examination. It is well known that the mitral diastolic murmur may be present one day and absent another. In differentiating between functional and organic systolic murmurs, the examiner must rely upon his evaluation of the murmur itself. If left auricular enlargement is found, however, it can be considered as confirmatory evidence.

From the point of view of the procurement officer fluoroscopy would be the most valuable single procedure if the equipment were available and if an experienced person conducted the examination. Estimation of the cardiac area from an x-ray film would furnish information, adequate to arouse serious suspicion of mitral stenosis or other definite heart disease in some instances, but would be of no other value in differentiating between functional and organic systolic murmurs.

Heart sound tracings were found to be of real value in occasional instances but these were too uncommon to warrant widespread use of stethographic equipment.

SUMMARY

A group of 165 subjects with systolic murmurs at the apex were examined clinically, with the electrocardiograph, and in many instances by x-ray film examination, fluoroscopy, a standardized exercise tolerance test, and stethogram. On the basis of clinical judgment they were divided into three groups: Those with functional systolic murmurs, those with organic systolic murmurs (mitral insufficiency), and those with mitral stenosis. The abnormal responses to the various tests were tabulated and analyzed. As the result of this analysis certain findings were found to be of corroborative value in the diagnosis of mitral valve disease.

CONCLUSIONS

1. The anatomical changes associated with mitral stenosis were found to be reflected in the electrocardiogram; a P wave of 3.0 mm. in height in the second lead being found in 23 percent; and a P wave 0.12 seconds or more in width in any lead being found in 27 percent of the cases. The changes in organic systolic murmurs were too small to be of diagnostic value.

2. Enlargement of the left auricle, usually demonstrated by fluoroscopy, was found in 5 percent of subjects with functional systolic murmurs, in 43 percent with organic systolic murmurs, and in 72 percent with mitral stenosis, thereby establishing itself as of considerable value as a diagnostic criterion.

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3. Exercise tolerance tests were found to be of no value in differentiating between functional and organic systolic murmurs.

4. Heart sound tracings were found to be of value in isolated instances where the precise timing of a murmur or sound was important. This was particularly true in regard to reduplication of the first heart sound and in regard to duration of systolic murmurs.

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ORAL AND RECTAL TEMPERATURES AFTER EXERCISE

Temperatures taken by rectum are about 1° F. higher than those taken by mouth. The body temperature rises several degrees as a result of exercise, the extent of rise being dependent on the amount, intensity and nature of the exertion. Recently Brennemann reported the recording of the rectal and oral temperatures just before and just after various degrees of exercise in 10 children and 3 adults, all apparently in sound health. The rectal temperatures rose from 1° to 4° F. higher after exercise while oral temperatures remained relatively unchanged, rose only slightly or even dropped. The increase in rectal temperatures and hence the variation from the oral was directly proportional to the intensity of the exercise. Normal temperatures both by rectum and by mouth were resumed in from 30 to 60 minutes. The clinical implications are obvious: A high afternoon or postexercise rectal temperature in a child cannot be presumed to reflect a disease process and conversely the danger of such a high temperature masking a disease process should not be overlooked.—Editorial. J. A. M. A. 123: 96, September 11, 1943.

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BLOOD PRESSURE AND MAJOR SURGERY

Evidence to show that, "Symptomatic relief and reduction in blood pressure resulting from nonspecific surgical measures (e. g., hysterectomy, prostatectomy, cholecystectomy) in the presence of essential hypertension are similar to and sometimes better than those obtained by specific procedures (extensive sympathectomy, splanchnic nerve section, coeliac ganglionectomy) performed especially for those purposes in the treatment of essential hypertension," has been produced.

To clarify the issue, some investigation to determine blood pressure changes associated with major nonspecific operations and to compare them with those claimed for various sympathectomy operations has been done.

Several conclusions may be drawn from the study:

Hospitalization and major surgery is associated with a definite drop in systolic pressure; indeed, the only exceptions were a few cases with very low blood pressure.

The extent of the reduction varies directly with the height of the preoperative blood pressure, i. e., those with low pressures show only slight total and percentage reduction, whereas those with hypertension show a marked fall.

There is a marked contrast in liability in various groups. Those with low or normal readings continue at a fairly steady level throughout, while those with hypertension swing through a wide range. But each deflection, whether up or down, is directly proportional to the height of the original blood pressure. This is true not only when measured by actual millimeters of mercury, but also when it is computed in percentage of the initial pressure.

Rebound from postoperative depression of blood pressure is more prompt and more vigorous in those with lower pressure.

It is, however, obvious that alleged specific effects must be measured against known nonspecific effects which take place concurrently with all surgical operations. Careful and prolonged observation under various conditions must be made before and after sympathectomy before definite conclusions can be arrived at.—Adamson, J. D., and Dubo, S.: The effect of surgical operations on blood pressure. Canad. M. A. J. 49: 161–166, September 1943.

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ELECTROENCEPHALOGRAPHIC DIAGNOSIS OF ORGANIC BRAIN DISEASE[1]

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Electroencephalography is specifically indicated in cases of epilepsy, head trauma, and space-taking lesions involving the cortex (*1*) (*2*). It is used routinely at the Naval Hospital, Philadelphia, on all cases that give a history of repeated headaches, head injuries, fainting spells, convulsions, or other symptoms suggestive of organic brain disease (*3*).

From a clinical viewpoint, the electroencephalogram (EEG) is a record of the electrical activity of the ganglion cells in the gray matter of the cortex. In a normal EEG this activity appears as a regular pulsation 9 to 11 (or more) per second in rate, and 10 to 30 microvolts in amplitude. In an abnormal EEG this rate is slowed (2 to 7 per second) and the amplitude is either increased or decreased. Abnormalities in the EEG must be interpreted in the light of the clinical findings; except possibly for the spike wave formations seen in some cases of epilepsy and the low amplitude response seen in some cases of cortical atrophy or subdural hemorrhage, there are no specific EEG patterns associated with specific clinical conditions. The great value of the EEG is that it permits early recognition of organic cortical disease and indicates whether it is focal or general.

METHOD OF EXAMINATION.

The recording of an EEG is a simple clinical procedure. For the test the patient sits comfortably in a chair or rests in bed with his eyes closed to avoid artefacts due to ocular movements. In a routine examination electrodes are placed on the scalp along a line drawn from the midorbit to the occipital region, four to each hemisphere, over the respective frontal, rolandic, parietal and occipital areas. More lead electrodes are used whenever necessary to localize tumors, scars or epileptic trigger areas. If possible all sedation should be discontinued for 48 hours prior to examination to avoid masking abnormalities.

[1] This study was aided by a grant to the Institute of the Pennsylvania Hospital from the John and Mary R. Markle Foundation and from the Supreme Council Thirty-third Degree Scottish Rite Masons.

[2] Director of Laboratories, The Institute of the Pennsylvania Hospital, Philadelphia, Pa.

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TABLE 1.—*EEG findings in a group of 205 patients with various neurologic conditions*

Diagnosis	Number of patients	EEG findings		Diagnosis	Number of patients	EEG findings	
		Positive	Negative			Positive	Negative
Abscess, brain	1	1	0	Hydrocephalus	1	1	0
Aneurysm, intracranial	1	0	1	Landry's paralysis	1	0	1
Arachnoiditis	1	1	0	Mental deficiency	2	0	2
Atrophy, cortical	4	4	0	Multiple sclerosis	6	2	4
Cerebellar thrombosis	3	1	2	Psychoneurosis	25	5	20
Chorea	1	1	0	Psychopathic personality	22	4	18
Encephalitis	4	3	1	Psychosis:			
Encephalopathy:				Manic depressive	1	0	1
Hypertensive	12	9	3	Schizophrenic	1	0	1
Cerebrovascular	24	14	10	Korsakoff's	1	0	1
Alcoholic, chronic	9	3	6	Unclassified	1	1	0
Epilepsy:				Somnabulism	1	1	0
Essential	37	32	5	Syphilis-CNS	6	5	1
Post-traumatic	5	4	1	Trauma, head	25	16	9
Hemorrhage, subdural	1	1	0	Tumors, brain	9	9	0

RESULTS.

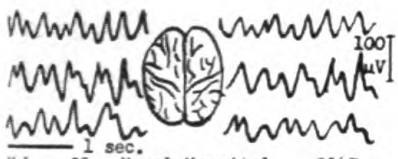
Table 1 shows the number of positive and negative EEG findings in a group of 205 patients with various neurological conditions. Any record that was questionably positive was listed as being negative in this table. In many of the diagnostic groups in this study there were not a sufficient number of patients to evaluate the accuracy of the EEG. However, the large number of positive electrical findings in encephalitis, encephalopathy, epilepsy, multiple sclerosis, central nervous system syphilis, head trauma and brain tumor give a good indication of the great clinical value of this test. The negative findings in the psychoneuroses and psychopathic conditions were helpful in ruling out organic cortical changes.

EPILEPSY.

Abnormal EEG's were found in 32 out of 37 patients who had essential epilepsy (86 percent). This is within the expected degree of accuracy for a single test. All epileptics have abnormal electrical findings at some time or other in their cycle. Those who have a mild type of epilepsy may have normal tracings between their attacks or only brief showers of abnormal rhythms. In this group of patients, latent cortical abnormalities may be brought out by producing a mild degree of alkalosis by 1 or 2 minutes of overbreathing. Other patients with a more severe type of epilepsy show abnormal electrical activity whenever examined.

In a normal EEG the cerebral potentials vary from 9 to 11 (or more) in rate, and range from 10 to 30 microvolts in amplitude, as shown in the left column of figure 8. In epilepsy these rhythms are slowed in rate (3 to 8 per second) and increased in amplitude (50 to 100 microvolts) (fig. 1) or spike wave formations may develop (fig. 2). In this group of patients the abnormal findings were seen throughout both hemispheres; none had a focal type of epileptic ormality (*4*) (*5*).

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H.L. 52 Naval Hospital 2367
C.C. Convulsive seizures 25 years
EEG Abnormal waves throughout both hemispheres.
Diag. Epilepsy

FIGURE 1.



R. DiG. 16 I. 2310
C.C. Fainting spells 5 years
Impulsive behavior
EEG Abnormal waves both hemispheres. *Spike wave formations appeared after one minute of hyperpnea.
Diag. Epilepsy - Petit Mal.

FIGURE 2.

HEAD TRAUMA.

Sixteen out of a group of 25 patients who had head trauma showed abnormalities in the EEG. These findings were general in 6 and focal in 10. Nine patients had recovered from the effects and showed negative tracings.

Cerebral concussion, contusion or laceration always produce EEG changes. These usually consist in a slowing in the frequency and an increase in amplitude (*6*). Post-traumatic electrical findings may still be detected from 1 to 3 months after clinical recovery.

The EEG findings in two patients with post-traumatic epilepsy are shown in figures 3 and 4. A subdural hemorrhage may result in diminishing the amplitude of the brain potentials as is shown in figure 5. In this patient there were three-per-second rhythms in the



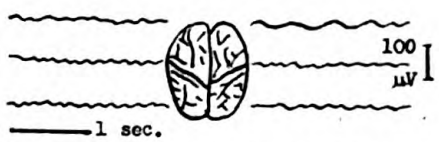
W.M. 43 Naval Hospital 1730
C.C. Head Trauma 1918. Convulsions since 1923.
EEG Abnormal waves both hemispheres.
Diag. Traumatic Epilepsy.

FIGURE 3.



W.N. 29 Naval Hospital 2646
C.C. Head Trauma, headaches, vertigo, convulsions.
EEG Abnormal waves both hemispheres. *Increased following hyperpnea.
Diag. Traumatic Epilepsy.

FIGURE 4.



V.M. 42 Naval Hospital 783
C.C. Headaches since head trauma four months ago.
EEG Abnormal slow waves right frontal area. Poorly developed rhythms both hemispheres.
Diag. Ventricles displaced to left. Subdural hemorrhage.

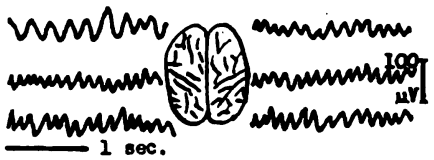
FIGURE 5.

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right frontal lobe. Subsequent air studies revealed the presence of a subdural hemorrhage in this area which had displaced the ventricles to the left.

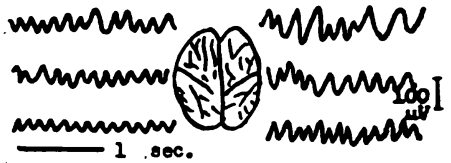
BRAIN TUMOR.

An EEG is indicated as part of the routine work-up of all patients suspected of having a brain tumor. If the tumor involves the cortex it will be detected with great accuracy; midbrain and posterior fossa



S.G. 51 Naval Hospital 991
C.C. Headache, Vomiting, Tinitus.
EEG. Abnormal waves left fronto-temporal area.
Diag. Brain Tumor - Left Fronto-Temporal.

FIGURE 6.



W.R. 58 Naval Hospital 1189
C.C. Confused, Unable to walk.
EEG. Abnormal waves right fronto-parietal and left frontal areas.
Diag. Brain Tumor - Right Fronto-Parietal Area.

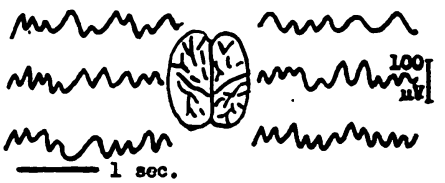
FIGURE 7.

lesions will be missed (*7*). Nine patients were referred for an EEG because they were suspected of having space-taking cortical lesions. All of these had abnormal tracings. Eight of them showed a focal type of abnormality; 3 of these tracings are shown in figures 6, 7, and 8. A generalized type of abnormality was seen in one patient. This patient had a carcinoma with cerebral metastasis (fig. 9). The EEG findings in this group of patients were confirmed clinically. As a rule 85 to 90 percent of cortical lesions will give positive EEG find-



H. Mc. 49 Naval Hospital 965
C.C. Headache, Vomiting, Left Sided Weakness
EEG. Abnormal waves right fronto-temporal parietal area.
Diag. Brain Tumor - Right Hemisphere.

FIGURE 8.



W.B. 61 Naval Hospital 872
C.C. Weakness left side and right leg.
EEG. Abnormal waves both hemispheres.
Diag. Carcinoma with cerebral metastasis.

FIGURE 9.

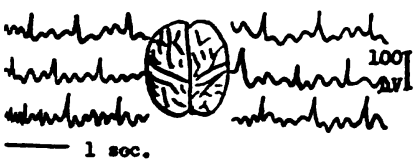
ings, subcortical lesions will be missed unless they produce a reflected change in the overlying cortex. Posterior fossa lesions give positive EEG findings in about 10 percent of cases. A false localizing EEG finding may result occasionally from contrecoup irritation from a lesion in the opposite hemisphere. This should be suspected if the EEG localization is at variance with the neurologic findings. Meningiomas may give minimal electrical findings despite pronounced

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neurologic changes. Occasionally a glioma involving both hemispheres gives minimal findings. The EEG's greatest help is in the localization of frontal lobe lesions which fail to give focal neurologic signs.

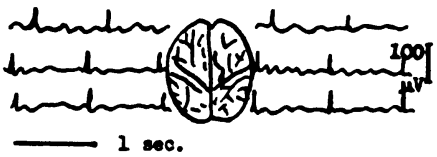
CEREBROVASCULAR DISEASE.

Cortical arteriosclerosis, hemorrhage and thrombosis are revealed in the EEG by the presence of slow waves of increased or decreased amplitude. These abnormalities are as a rule less pronounced than those seen in cases of inflammatory or space-taking lesions. Fourteen out of a group of 24 patients with cerebral vascular disease had abnormal tracings. One patient with a cerebellar thrombosis also had



C.F. 43 Naval Hospital 1004
C.C. Headache, stroke left side.
EEG Abnormal sharp waves both hemispheres.
Diag. Hypertensive Encephalopathy. B.P. 180/130. Cerebral Vascular Disease.

FIGURE 10.



A.C. 51 Naval Hospital 931
C.C. Weakness Right Side. Depressed Agitated.
EEG Abnormal sharp waves both hemispheres. Poorly developed rhythms.
Diag. Hypertensive Encephalopathy B.P. 150/100. Arteriosclerosis generalized.

FIGURE 11.

an abnormal tracing probably because of accompanying arteriosclerotic changes in the cortex.

Patients with hypertensive cerebrovascular disease showed abnormal tracings in 9 out of 12 cases. The most characteristic finding in this hypertensive group is the appearance of isolated sharp spikes (figs. 10 and 11).

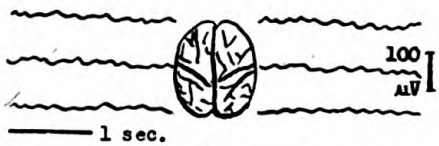
OTHER CONDITIONS.

Central nervous system syphilis (fig. 12), chronic alcoholism (figs. 13 and 14), encephalitis (fig. 15), multiple sclerosis (fig. 16) and meningitis give rise to abnormal EEG findings in a varying percentage of cases as shown in table 1.

Schizophrenia, manic depressive psychosis or involutional melancholia and the psychoneuroses give normal electrical findings. Psychopathic personality developing on a constitutional, environmental, or psychologic basis likewise gives normal findings. The EEG is abnormal in behavior disorders only when this condition arises as the result of organic changes. This may be expected to be the case in 18 to 20 percent of patients (*8*).

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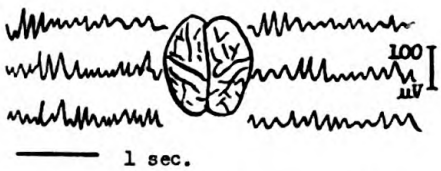
J.F. 53 Naval Hospital 882
C.C. Nervousness, headaches, left sided Jacksonian seizures.
EEG Abnormal low voltage waves both hemispheres.
Diag. Central nervous system syphilis.

FIGURE 12.



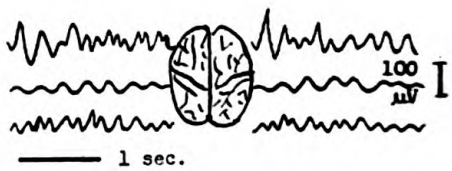
H.G. 53 Naval Hospital 1056
C.C. Alcoholism. Convulsive seizures five years.
EEG Abnormal waves both hemispheres.
Diag. Chronic Alcoholism. Encephalopathy.

FIGURE 13.



J.S. 19 Naval Hospital 1331
C.C. Alcoholic Delirium
EEG Brief showers of abnormal waves.
Diag. Alcoholism. Psychopathic personality.

FIGURE 14.



R.W. 18 Naval Hospital 2217
C.C. Drowsiness, Lethargy. Gained 67 lbs. following febrile illness 3 years ago.
EEG Abnormal waves both hemispheres.
Diag. Encephalitis

FIGURE 15.



H.Z. 46 Naval Hospital 1608
C.C. Slurred speech, intention tremor, memory loss, poor judgement.
EEG Abnormal waves both hemispheres.
Diag. Multiple Sclerosis

FIGURE 16.

SUMMARY

The EEG is another diagnostic procedure. It is of the greatest value in the diagnosis of cortical lesions and as such it becomes an intricate part of the psychiatric and neurologic examinations.

In this study it proved its merit in the differentiation of the epilepsies, the localization of cortical tumors, the exclusion of organic disease in those with functional disorders and as an index of progressive repair in intracranial trauma. Its diagnostic aid was evidenced in the acceleration of the diagnosis and the onset of therapy and a shortened period of hospitalization. The latter should make the EEG a definite asset in the military services, especially at this time.

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VERTICAL STANCE OF MAN

The evolution of the biped stance has been marked by a narrowing of the base of support and a progressive elevation of the center of gravity of the body as a whole. Both mitigate against stability. The vertical posture also imposes an hydrostatic handicap which encroaches enough on the adequacy of the circulation to make man in the upright stance vulnerable to peripheral circulatory collapse. The numerous difficulties seemingly attributable to the change from quadruped to biped standing are interpreted by some as signs of extreme inadequacy of adaptation. However, compensatory mechanisms automatically cancel the apparent mechanical disadvantages of the change so that gravitational stresses are counteracted easily in the majority of normal men.

The steadiness of standing is affected little by mechanical factors in build. Although the center of gravity of the body as a whole shifts incessantly during relaxed and effortless standing, the patterns formed by a trajectory of the shifting center of weight and the mean position of the vertical projection of this theoretical point are relatively constant. The phenomenon of standing is elaborately protected by a multiplicity of cooperating reflexes.

Gravity is the major deforming force affecting man's stance, and postural sway a constantly varying stimulus to the stretch afferents. In this way tonus is automatically adapted to the collapsing forces which must be equilibrated by the antigravity extensor muscles.

Standing is cheap in terms of metabolic cost and it has yet to be demonstrated unequivocally that improvement in so-called body mechanics is associated with a significant decrease in energy exchange. The remarkable indefatigability of relaxed standing has not been fully explained.—Hellebrandt, F. A., and Franseen, E. B.: Physiological study of the vertical stance of man. Physiol. Rev. 23: 220–225, July 1943.

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PARAGONIMIASIS (ENDEMIC HEMOPTYSIS)

REPORT OF 3 CASES

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Lieutenant Commander (MC) U. S. N. R.
and
DWIGHT L. WILBUR
Lieutenant Commander (MC) U. S. N. R.

The appearance of paragonimiasis in Naval and Marine Corps personnel returning from the tropics is worthy of report because of the general lack of familiarity with this disease in continental United States. A brief review of the subject and a description of three cases observed at a naval hospital follows.

Paragonimiasis is infection with the lung fluke Paragonimus westermanni (or ringeri).[1] Synonyms are pulmonary distomiasis and endemic hemoptysis. The name lung fluke and the term endemic hemoptysis are both open to criticism because infection may occur elsewhere than the lungs, entirely sparing them, and even when the lungs are involved there may be no hemoptysis.

HISTORICAL.

The parasite was first described by Kerbert in 1878 in the lungs of a tiger dying in the Amsterdam Zoological Gardens. The first human cases were described by Manson and by Baelz in 1880 in the Orient. Ova were present in the sputum of a Chinese with hemoptysis. Ringer in 1881 described the adult fluke in man. A different species, P. kellicotti, was described in the cat in this country in 1894 by Ward. P. kellicotti has since been obtained from dogs, hogs, minks and other animals in the Mississippi basin. It is believed by Ameel (*1*) that the mink is the usual definitive host in this country.

The first case to be reported in this country of human infection due to P. westermanni was described by Mackenzie (*2*) in 1904. His patient was a Japanese fisherman.

Human paragonimiasis is endemic in Formosa, Korea, Japan, China, the Malay Peninsula, and the Philippines. Occasional cases have been reported from the Dutch East Indies, India, the Congo, Tripoli, and tropical South America.

LIFE CYCLE AND PATHOGENESIS.

As the life cycle of the fluke and the pathogenesis of the disease it produces are continuous events, the truly vicious circle will be broken by beginning with the egg. Ova are expectorated, or passed in the

[1] Authorities disagree as to whether P. westermanni and P. ringeri are the same or different species.

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feces of infected man or animal. Under proper conditions of temperature and moisture, a miracidium emerges from the egg and penetrates a snail of the proper species. The miracidia become sporocysts in the snail's lymphatics. These in turn become rediae which reproduce once. About three months after infection the second generation rediae have produced cercariae. After an indefinite but probably short period, the cercariae directly penetrate the chitin of crayfish or crabs and produce a generalized infection. The cercariae encyst and are termed metacercariae.

Human or other mammalian infection results from the ingestion of raw or improperly cooked crab or crayfish. (Pickled or spiced-wine crab, an oriental delicacy, is likewise infective.) The cyst of the metacercaria is digested away from the larval worm and the latter burrows into jejunal villi. In experimentally infected kittens and puppies the progress of the worm has been traced from the intestine. Often within 24 hours the intestine is pierced and the peritoneal cavity entered. Within another 2 days the worm may have pierced the diaphragm. From the pleural cavity the lungs are usually entered in a minimum time of 3 weeks. There, the young hermaphroditic worms grow to maturity. Two or more are found together in a "burrow" forming a small cyst communicating with a bronchiole. Sexual maturity is reached in 6 weeks and the operculated eggs are produced. Clumps of brown eggs are discharged into the sputum along with glairy, blood-streaked mucus.

Ameel has emphasized, however, that all the young worms may not penetrate the diaphragm. Some stay behind in the peritoneal cavity where they have been found, fully grown, 8 months later.

The complex life cycle of this parasite was elucidated by Nakagawa (*3*). It has been confirmed by Ameel in this country with P. kellicotti. Ameel, furthermore, has made the significant observation that infection may be transferred from one animal to another directly without passing through snails and crayfish. Using immature (185-day-old) worms taken from the pleural or peritoneal cavities of infected rats, he was able to infect cats by mouth. (Mature worms from lungs however, were not infective.) Ameel's experiments raise the possibility of direct infection occurring in nature. It is conceivable that man might be infected by eating improperly cooked viscera of infected hogs, or even dogs, as is customary among natives of the South Seas.

PATHOLOGY.

In 1907, Musgrave (*4*) described the pathologic findings in eight cases autopsied by him in the Philippines. Flukes and their ova were found in the lungs and in the pleural and peritoneal cavities. They were also occasionally present in the pectoral muscles and intestinal

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wall where extensive ulceration was produced. Surprisingly, Musgrave also found the ova of Paragonimus in the superficial and deep lymphatics, under ulcerations of the skin, in the heart and pericardium, liver, appendix, meninges, and choroid plexus. Generalized dissemination of ova by lymph channels and blood stream followed. In two of Musgrave's cases the thorax was not involved at all.

Nonsuppurative lesions were found most often on serous surfaces, in connective tissue, intestinal submucosa, liver, and lung. They consisted of proliferating connective tissue and round cell infiltration. Tubercle-like lesions were encountered in the lung. Here, giant cells were seen surrounding clusters of eggs and caseating nodules were present. Suppurative lesions were of two kinds, those resembling ordinary pyogenic abscesses and the more specific slate-blue colored cysts. These latter contained adult flukes, their ova, and a material the consistency and color of "anchovy sauce." Ulcerative lesions of the skin and mucosa showed little acute inflammatory reaction and their edges exhibited a bluish color. Intestinal ulcers resembled those of tuberculous or amebic infections.

SYMPTOMATOLOGY.

Paragonimiasis is generally considered to be a chronic disease, though cases of generalized infection, often complicated as by tuberculosis, may run a rapid course with fatal termination. The onset of the disease is insidious and there then follow gradually increasing symptoms referable either to the chest, to the abdomen, or to the lymphatic system.

In the pulmonary type, the classical "endemic hemoptysis", there is persistent cough with the expectoration of viscid sputum containing brown flecks. Streaks of blood are common but not constant. Massive pulmonary hemorrhage is not described. Chest pain is the rule. Physical examination yields the signs of bronchitis or bronchiectasis.

The sputum contains small operculated eggs from 62 to 98μ in length (Musgrave). The shell is thin, but doubly refractile, and the operculum resembles "a cork in a bottle". It is not distinctly seen in many instances. Within the shell a dark nucleus, the ovum, is seen surrounded by golden brown yolk cells. Heart failure cells may be present in abundance and must be carefully differentiated from the eggs.

Fever and leukocytosis occur in extensive and complicated infections but may be absent. Eosinophilia may or may not be present.

In the abdominal type of the disease, dull abdominal pain occurs. Moderate rigidity and tenderness on deep palpation are present. Tenderness may be almost anywhere. Diarrhea with the passage of

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blood which suggests amebiasis may occur. Liver enlargement and tenderness may be present as the lung fluke has been found in the bile ducts. Funiculitis and epididymitis may occur. Psoas abscess is described. The diagnosis can be established only by finding ova in the stools or by laparotomy.

Symptoms of generalized infection are those of glandular fever, tropical ulcers, and myositis. Here, as when epididymitis occurs, differentiation from filariasis becomes necessary. Biopsy is indicated.

In Japan cerebral paragonimiasis is considered in cases of Jacksonian epilepsy. A case of transverse myelitis due to paragonimus infection has also been described.

The duration of symptoms of infection may be a matter of years. Fehleisen and Cooper (*5*), reporting the second case in this country in 1910, described an infection of at least 6 years' duration. Their patient, a Japanese of 35 years, had suffered from hemoptysis since the age of 12 years. At 24 years of age his case was diagnosed by a Japanese physician. He migrated to this country at the age of 29. Since reinfection just before leaving Japan cannot be excluded, the minimum possible duration of his case was 6 years but the maximum was 23 years.

The diagnosis of paragonimiasis, therefore, must be considered in cases presenting a great variety of symptoms—thoracic, abdominal, lymphonodular, and cerebral.

The following cases illustrate many of the above-described symptoms (other than cerebral).

CASE REPORTS

Case 1.—The patient, a Marine Corps officer 23 years of age, entered the hospital 1 January 1943 complaining of hemoptysis, cough, weakness, and pain in the left leg and the lower half of the chest. These symptoms began in August 1942, 4 months after his arrival, and while he was on duty in British Samoa. During this 4-month period the patient undertook severe commando training in the jungle and underbrush. He was frequently exposed to innumerable insect bites. He states that he ate only food prepared by, or approved by, members of the staff of the Marine Corps; although, on one occasion late in August he ate native roast pig and fruits.

Early in August the patient noted some cough with expectoration of brownish material, as well as weakness and fatigue after moderate exertion. Night sweats and pain, apparently deep in the chest, occurred and were followed in 2 weeks by pain and aching in the left leg and groin. Subsequently, there occurred on the left leg shallow ulcers surrounded by a purple ring approximately 2.5 cm. in diameter. Local pruritus was present. On 15 September following violent physical exertion, the patient brought up 5 to 10 cc. of frothy blood during an episode of violent coughing. Despite the fact that his symptoms were becoming progressively worse, he continued his duties until 2 October when he coughed up about 500 cc. of blood and fainted. Of the subsequent 24 days during which he was hospitalized the patient remembers little. He apparently was febrile, confused mentally, and had persistence of cough and hemoptysis, occasional vomiting, and pain in the chest and left leg.

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Examination during this period failed to reveal objective evidence of significant disease other than the ulcers of the left leg. There was some fever but the chest was entirely clear and x-rays were reported to have shown some increase in the prominence of the hilar shadows. Blood count and urinalysis were normal. Sedimentation rate of the blood was 11 mm. in 1 hour, and studies of the sputum did not reveal acid-fast organisms.

During December, while on a transport, the patient occasionally expectorated as much as 200 cc. of blood.

At the time of admission to this hospital the outstanding symptoms were:

1. A loud and racking cough occurring periodically throughout the day and at night, audible all over the ward and productive of 2 or 3 ounces of stringy yellowish-brown sputum containing small amounts of blood.

2. Pain of a peculiar type in the lower half of the chest, pain which was constant in character, not accentuated by breathing but eased by strapping the chest and aggravated by coughing.

3. Constant dull pain in the left leg below the knee and in the region of the tibia, associated with hyperesthesia of the skin of the leg and exaggerated by deep pressure over the tibia and calf muscles.

4. Constant dull pain in the left groin, the upper inner aspect of the left thigh, and left lower anterior abdominal wall.

The antecedent medical history of the patient was noncontributory except for the fact that in January 1942, while in training, he was thrown from a horse and coughed up a moderate amount of blood once shortly thereafter. The patient was a native of the United States and had not been out of the country until April 1942.

On physical examination, the patient was well developed and well nourished, although a bit thin. The face and eyes were flushed and as he sat in bed he coughed frequently and loudly. The positive findings on examination were as follows:

1. There was strapping of the lower chest bilaterally with limited but equal expansion even after removal of the adhesive. The breath sounds were normal in quality, although diminished throughout the lungs.

2. There was tenderness over the lower left abdominal wall; just lateral to the left rectus, several centimeters above the inguinal ligament, there was a small, indefinite, but tender mass in the abdominal wall.

3. Small, somewhat tender, lymph nodes were palpable in each inguinal region.

4. There was tenderness of the upper, inner aspect of the left thigh, and of the leg below the knee, associated with mild hyperesthesia of the skin of the left leg.

5. Cyanosis of the left leg and foot were prominent when they were in the dependent position, but edema was absent.

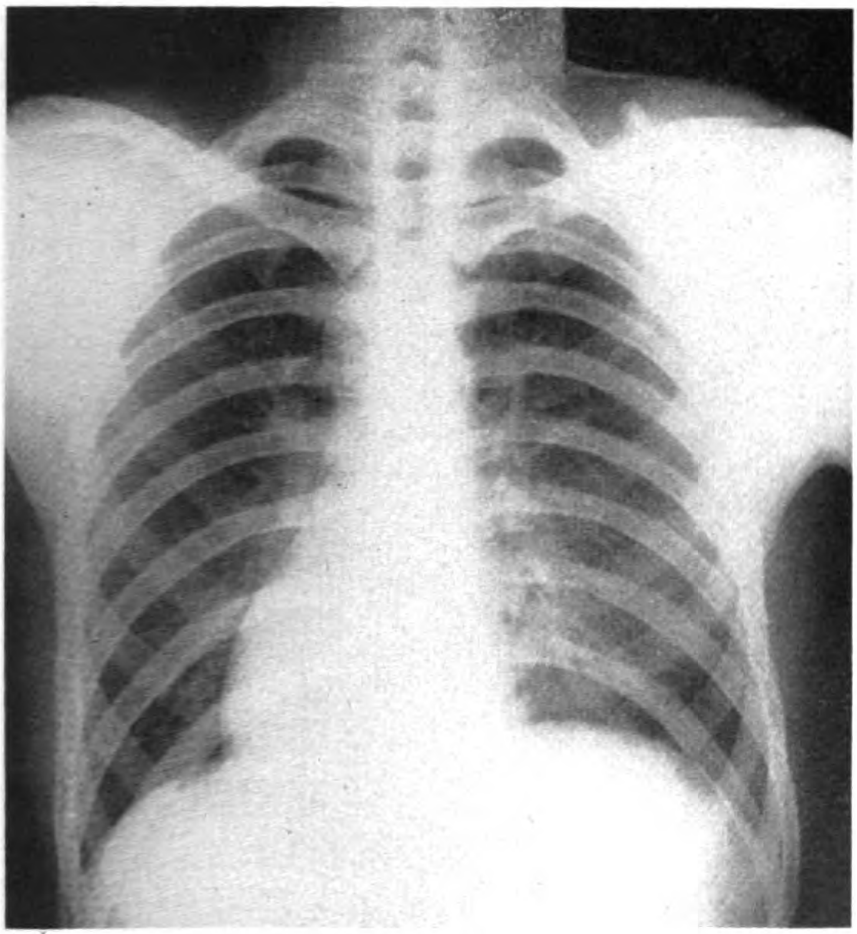
6. A small, 3 by 5 mm., extremely firm, tender, movable nodule was palpable just beneath the skin over the upper portion of the lower third of the tibia and in the neighborhood of it were 4 or 5 circular pigmented scars about 5 cm. in diameter.

Studies of the urine on numerous occasions showed it to be normal. Blood count made on 12 January 1943 showed the hemoglobin to be 80 percent; leukocytes numbered 10,400, with neutrophils 55 (stabs 1), eosinophils 2, lymphocytes 37, and monocytes 6 for each 100 cells. Sedimentation rate was 7 mm. in 1 hour. Kahn test for syphilis was negative. A smear of the blood for microfilaria was negative. Roentgenologic examination of the chest (fig. 1) disclosed an appearance described as pneumonitis of the right base, probably secondary to

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bronchiectasis; there was a small amount of opaque oil in the area. X-rays of the left hip, left femur, and leg gave negative results. Examination of the sputum for acid-fast organisms was negative and culture of it did not disclose any pathogenic organisms. Examination of fresh, unstained sputum on 19 January 1943 disclosed ova of Paragonimus westermanni (fig. 2).

Bronchoscopy disclosed an extremely injected mucosa in the bronchial tree, otherwise it was negative. Microscopic study of the subcutaneous nodule in the left leg revealed a thin fibrous walled cyst containing many degenerating lipoid crystals and a few pigmented granules. It was interpreted as an inclusion cyst. Study of a lymph node removed from the left inguinal region revealed a normal



1. Case 1.

appearing node with parenchymatous hemorrhage. An examination of the spinal fluid showed it to be normal.

The clinical course of the patient has been one of continued, but slow, improvement. There has been marked decrease in the cough and reduction in the daily sputum from several ounces to less than one-half ounce daily. Ova are present. Gross blood, which was frequently brought up in the first few weeks after arrival at the hospital, recently has occurred rarely. The temperature curve reveals low grade fever which is remittent and lessening. There is much less pain in the chest but it continues. The pain in the left leg is approximately unchanged. The patient feels better generally, and has gained considerably in appetite and

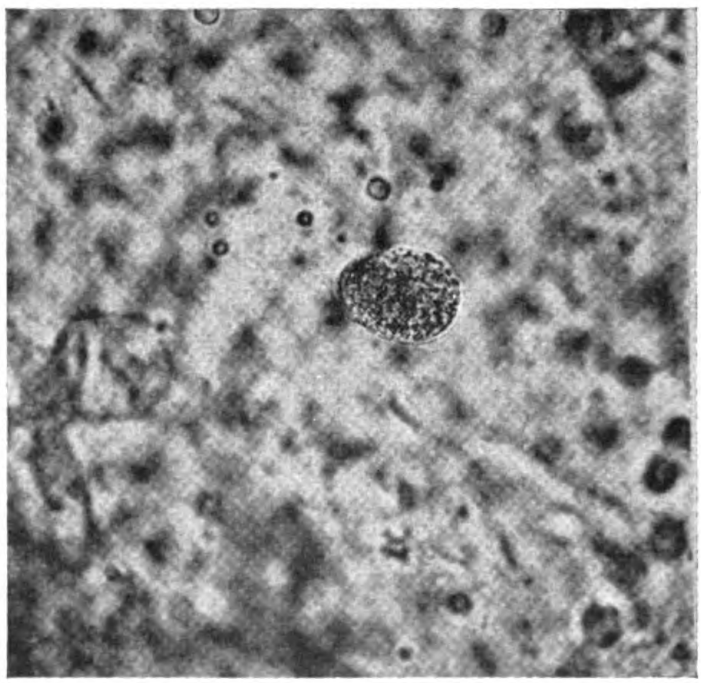
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strength. An x-ray of the chest on 5 February showed considerable improvement in the amount of pneumonitis in the right base.

Treatment to date has consisted of rest in bed, a course of emetin (0.06 gm. subcutaneously daily for 6 doses), sulfadiazine (5 gm. as an initial dose followed by 6 gm. daily for 12 days) and injections of lipiodol into the bronchial tree.

Case 2.—This patient, a private in the Marine Corps, age 18 years, developed pain in the left knee early in August 1942 while in the Solomon Islands. The discomfort became increasingly severe on walking and made it difficult for him to straighten his leg. It subsequently extended into the thigh and left inguinal region. Some relief was obtained by flexion of the thigh and the leg. Mild edema of the calf and thigh occurred and lasted approximately 3 weeks. At this time physical examination was essentially negative, the skin of the leg was normal and changes in temperature of it were absent. The temperature was normal. Laboratory studies revealed a leukocyte count of 10,800; erythrocytes numbered 2,980,000. X-ray of the pelvis was negative.

For a few days the patient managed to be up on crutches following which there



2. (Case 2.) Ovum of Paragonimus (×450)

developed soreness in the right thigh and leg and several days later an attack of acute abdominal pain and tenderness characteristic of acute appendicitis. The leukocyte count rose to 18,400; neutrophils 74 and eosinophils 11. On 23 September an acutely inflamed appendix was removed. Free fluid was not present in the abdominal cavity. The day after operation there developed marked swelling of the right leg and thigh and tenderness of the right calf muscles. Enlargement of the lymph nodes was not noted. Treatment consisted of an ice pack and administration of sulfadiazine.

Five days later there was swelling of the right thigh, an indurated, tender mass in the right femoral canal, tenderness along the course of the saphenous vein, and edema of the toes of the right foot. During the subsequent month the edema and pain gradually disappeared, although on assuming the erect position there was recurrence of pain in the calf and popliteal space of the right leg.

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On admission to the hospital on 12 November 1942, the complaints were of swelling of the lower extremities, tightness of the muscles in the lower extremities, a constant cough productive of mucoid expectoration, exhaustion after exertion, mushy bowel movements, and a daily frontal headache. The patient stated further that his persistent cough began in August 1942. It had been productive. No blood or chest pains were noticed however. Distention of the lower abdominal veins was first noted in October 1942.

The patient had been in American Samoa from April to July 1942. Subsequently he was in New Caledonia until his arrival in the Solomon Islands in August.

On physical examination the patient was found to be a well-developed and well-nourished young man. Over the abdomen there was distention of the superficial abdominal veins. The legs were slightly edematous and dusky red in color below the knees. There was some pitting edema but no apparent varicosity of the veins of the legs. Examination revealed a normal chest.

Laboratory studies were as follows: Urinalyses were repeatedly normal. The value for hemoglobin was 90.6 percent (14 gm.) and leukocytes numbered 11,900 with the following distribution: Neutrophils 57 (stabs 4), eosinophils 2, lymphocytes 38 and mononuclears 3. Sedimentation rate was 4 mm. in 1 hour. A subsequent leukocyte count was 8,700 with a normal distribution of leukocytes. X-rays of the chest, both legs, the urinary tract without dye, and the lumbosacral spine were normal. Kahn test of the blood was negative. Examination of the sputum on 3 occasions revealed the ova of Paragonimus westermanni. Studies of the blood for microfilaria were negative.

During his stay in the hospital the patient gradually improved. He has been free of edema while he is flat in bed, but after walking there is some aching and edema. The cough remains about the same. There has been very little fever and no pain in the chest.

Case 3.—A Marine sergeant, age 32 years, was admitted with the diagnosis of tracheobronchitis, chronic, on 12 December 1942. The onset was in April 1942, after 13 months' duty in American Samoa, with slight chest pain and cough. Occasional slight abdominal pain was present, but there was no diarrhea or vomiting. He gradually became worse and was hospitalized 29 July 1942, after a loss of 25 pounds in weight. Physical examination at that time revealed a low-grade afternoon fever up to 100° F. and rhonchi at the apices. X-ray showed increased peribronchial markings. The sputum was greenish-yellow at that time and was reported to contain streptococci and staphylococci. The patient was treated with sulfathiazole for 4 days. Improvement in the cough followed and the patient was returned to active duty on 9 September 1942.

On 20 October 1942, the patient had a chill and complained of weakness and cough. At this time moist râles were present at both apices and in the left axilla. X-ray revealed a density at the left apex. Blood count showed white blood cells 1,600; segmented neutrophils 52, bands 2, lymphocytes 36, and eosinophils 10; hemoglobin 80 percent. Brown flecks were noted in the sputum. Many examinations for tubercle bacilli at that time and on earlier entry were negative. The diagnosis was tracheobronchitis, chronic.

On admission to the hospital, the only complaint was of cough and weakness. Coarse râles were heard at both bases. A chest plate was entirely negative. Tuberculin test was negative. Blood count showed hemoglobin 98 percent; white blood cells 7,200 with segmented neutrophils 33, bands 2, lymphocytes 57, mononuclears 1, and eosinophils 7. Sedimentation rate was 3 mm. (Cutler). Repeated examinations for tubercle bacilli were negative. The sputum was tenacious and gray in color. Numerous small brown flecks were pres-

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ent. Examination of unstained sputum revealed ova of P. westermanni on 15 February 1943. The patient is receiving sulfathiazole and phenothiazine. He has failed to regain his weight. The cough occurs only on rising in the morning.

A history of eating crab once in Samoa was elicited. No hemoptysis has occurred at any time.

COMMENT

These three cases of paragonimiasis should be of unusual interest to clinicians because of the rarity of this disease in the United States. Surprisingly few cases have been reported and in all instances the patients have lived for some time in the Orient. The average clinician in this country, if he has heard of the disease at all, probably has only done so during a course in parasitology in medical school.

Attention should be called to the similarities in the clinical findings in these three patients and to certain features which were very striking. In the first place, the patients had symptoms of chronic pulmonary disease manifested by a persistent chronic cough productive of several ounces of sputum daily. The sputum was characteristic in that it was very sticky, contained small brownish clumps, and in one case was accompanied by blood streaking and gross hemoptysis. In case 1 the typical clinical picture of so-called "endemic hemoptysis" was present. In only one of the cases did physical examination of the chest reveal evidence of pulmonary disease. X-ray of the chest in two cases was negative, whereas in the other there was evidence of a pulmonary lesion at the right base simulating bronchiectasis. The second striking similarity between cases 1 and 2 was the presence of thrombophlebitis of the lower extremities, presumably resulting from pelvic or femoral vein lesions.

A striking peculiarity in the first case was the unusual pain in the chest. A similar type of pain has not previously been observed by us. It was deep in the chest, difficult to localize, constant, aggravated by severe coughing but not by breathing, and apparently partially eased by immobilization of the chest by strapping. In certain respects it suggested involvement of pleura. Even more striking in this patient was the constant character and distribution of pain in the left leg. It was accompanied by hyperesthesia suggesting involvement of the nerves as well as of the veins of the extremity. In the second case the enlargement of the superficial abdominal veins was a very interesting but unexplained observation suggesting obstruction of the inferior vena cava and possibly of the portal vein. The pathogenesis of this phase of the disease remains unexplained.

To our knowledge paragonimiasis has not been reported in the Samoan Islands.

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It seems advisable to suspect this disease in patients who have been in the South Pacific and who present symptoms of an unexplained chronic pulmonary disease with slight fever, cough, expectoration of brownish-yellow, tenacious sputum often containing blood; particularly if accompanying these symptoms there is a history of thrombophlebitis of the legs. Repeated search should be made for the characteristic ova in the unstained sputum of such a patient.

Effective therapy for this condition remains to be developed. The expectorated ova are not directly harmful to man or capable of infecting him. Whether in this country we possess snails and fresh water crayfish and crabs which will become vectors of this disease remains to be seen. Obviously, the sputum should be destroyed.

SUMMARY

Three cases of paragonimiasis—"endemic hemoptysis" have been observed in patients returning from islands in the South Pacific. The striking clinical features of these cases were persistent chronic cough, pain in the chest, and expectoration of a moderate amount of tenacious, colorless sputum containing small brown flecks. In one case only was there hemoptysis. In two cases there was severe and persistent thrombophlebitis involving the lower extremities.

The diagnosis of paragonimiasis was established by the examination of fresh unstained sputum which revealed the operculated ova of Paragonimus westermanni.

Since this report was written we have had under observation four additional cases of paragonimiasis with characteristic pulmonary symptoms in patients from Samoa in whom the diagnosis was established by observation of the characteristic ova in the sputum.

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TROPICAL EOSINOPHILIA

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A newly recognized endemic disease, apparently widespread in the coastal regions of southern India, has recently been described by Weingarten [1] under the name of tropical eosinophilia. It is characterized by a chronic paroxysmal cough, frequent attacks of asthmatic breathing, weakness, listlessness, loss of weight and appetite, and a marked leukocytosis ranging from 20,000 to 60,000, apparently due chiefly to an increase in eosinophils which constitute 50 to 80 percent of the total number of white cells.

The onset of the disease is gradual with a low-grade fever, splenic enlargement, apathy and weight loss. After about a week, hacking paroxysms of coughing begin, usually occurring in the early morning hours and frequently associated with moderately severe asthmatic attacks resembling true asthma in their response to adrenergic drugs. Physical examination at this stage reveals the constant presence of numerous sibilant and sonorous râles throughout the lungs and prolonged expiration. After 2 to 3 weeks the fever subsides but the remaining symptoms persist and become chronic, lasting for a period of years if untreated. The disease is benign and no deaths have been reported. Weingarten reports a series of 81 cases observed during a period of 5 years of private practice in Bombay. All the cases lived or had lived on the seacoast. There appeared to be no predilection for age, sex, or race. That the disease may be very prevalent in certain regions of India is suggested by the fact that dwellers in congested areas frequently complain of being awakened early in the morning by the din and clamor of the so-called night watchman's or "durwaun's cough." The x-ray appearance of the lungs is quite distinctive, consisting of a fine diffuse mottling with irregular, ill-defined pea-size areas of increased density scattered thickly throughout the lung fields, but following in general the course of the bronchi and being more numerous in the hilar and basal regions; the picture is not unlike miliary tuberculosis.

Thus far the etiology is unknown. The only two conditions commonly causing such a high degree of eosinophilia are eosinophilic leukemia and periarteritis nodosa. However the blood shows no abnormal forms of eosinophils to suggest leukemia and the benign course of the disease, as well as the absence of all clinical signs of periarteritis

[1] Weingarten, R. J.: Tropical eosinophilia. Lancet 1: 103–105, January 23, 1943.

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nodosa, other than the asthma, make this disease highly unlikely. Search for a parasite of etiologic significance has as yet been unsuccessful.

The diagnosis depends on the history, physical signs, eosinophilia, x-ray appearance of the chest and finally, on the dramatic response to treatment with arsenicals.

Weingarten discovered by the accident of administering neoarsphenamine to one of his patients who had syphilis concurrently with "tropical eosinophilia," that this drug was a specific cure, bringing about a dramatic fall of the total white cell and eosinophil count to normal and a complete alleviation of symptoms in 2 to 4 weeks. All cases thus treated have so far shown a complete remission. Moreover, stovarsol by mouth was equally effective. In each case there occurred early in the course of treatment a sharp rise in white count and eosinophil percentage followed by an abrupt fall to normal levels by the end of 2 to 4 weeks. This therapeutic efficacy of arsenic would tend to support the view that the disease is caused by a protozoan infection.

The following case, although somewhat complicated by concurrent disease, demonstrates all the typical signs and symptoms of tropical eosinophilia, including the dramatic response to arsenic.

CASE REPORT

The patient, a 30-year-old ensign, was first admitted to the hospital on 12 February 1943 with a complaint of fever, progressive weakness and weight loss of 6 weeks' duration.

His past medical history was noncontributory except that following a resection of the nasal septum in 1936 for chronic sinusitis he suffered from occasional moderately severe attacks of asthma for about 1 year, after which they disappeared until the onset of his present illness. A review of the systems revealed no other abnormalities.

In 1937 the patient was sent to India by a large oil company as salesmanager for the southern district. His headquarters were in Madras but he traveled extensively on both coasts. He spent the next 4½ years there, returning to this country in May 1942. While in India his general health was excellent. He had occasional attacks of mild diarrhea but frequent stool examinations were negative for parasites. He remained free from asthma and at no time complained of fever, cough, or other pulmonary symptoms.

In August 1942 he passed his physical examination and received his commission in the Naval Reserve.

The onset of the present illness in December 1942 was preceded by the development of a severe sty in the left upper eyelid which caused marked swelling and induration of the lid and finally ruptured in three separate places with release of considerable quantities of pus. It then subsided uneventfully after a course of 2 weeks. No cultures of the pus were taken. A week later, the last week in December, the patient began to have a recurrence of his asthmatic attacks nearly every night about 2 a. m. Early in January 1943, gradually increasing fatigue and progressive weight loss were first noted. As these symptoms progressed he began to have severe night sweats. Meanwhile his

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asthma had disappeared. He managed to stay on duty until 28 January when the symptoms finally became so severe that he reported at sickbay. He was found to have a temperature of 101° F. and was sent to the hospital.

Physical examination at that time showed no abnormal findings other than fever and slight percussion tenderness localized at the right costal margin in the anterior axillary line. The lungs were entirely clear.

Laboratory examination revealed a white count ranging from 15,000 to 20,000 with an eosinophilia of 15–20 percent. There was a slight secondary anemia. No malarial parasites were observed in the blood and no ova or parasites were found in the stools. Two blood cultures, melitensis agglutination, a blood Kahn test and the Felix-Weil test were all negative. X-rays of the heart, lungs, and abdomen were normal. The sedimentation rate was 60 mm. in 1 hour. Urinalysis was negative; a skin test with 0.1 cc. of echinococcus antigen was positive but the significance of this was considered questionable in view of the patient's history of allergy.

The patient continued to run a spiking temperature with daily afternoon peaks reaching 102° to 104° F. A course of emetine hydrochloride caused severe diarrhea after 6 days but had no other effect. He continued to become weaker.

On 12 February, 1943, the patient was transferred to a civilian hospital. Examination at this time revealed a weak, listless man, cooperative but obviously acutely ill and showing evidence of marked recent weight loss. Aside from the weakness and lack of appetite he had no specific complaints. The temperature was 104.6° F., pulse 108, respirations 20. There was no cough or dyspnea. The skin showed no rash or jaundice. The lungs were clear and the heart normal. The blood pressure was 110/70. The only positive finding on physical examination was a sharply localized area of acute deep tenderness on percussion over the right costal margin. The liver was not enlarged to palpation, the spleen was not felt and there was no abdominal tenderness.

The laboratory findings were essentially the same as already described except that a barely discernible but definite diffuse fine pin-point to pea-size mottling of both lung fields was visible by x-ray; the significance of this was not appreciated at the time. An echinococcus complement-fixation test was found to be negative. A gallbladder series was normal. Repeated blood cultures both aerobic and anaerobic, showed no growth of organisms. The blood sugar was 100.7 mg. percent, plasma N. P. N. 34 mg. percent, plasma albumin 3.35 percent, globulin 3.33 percent, giving a total of 6.68 percent with a low A/G ratio of 1.01. Stool cultures revealed no significant organisms.

The patient continued to run the same high, spiking temperature and grew weaker and more anemic. A tentative diagnosis of liver abscess was made and he was transferred and sent to a naval hospital for laparotomy on 21 February 1943.

At operation a large abscess measuring 5 by 5 cm. was found in the right lobe of the liver from which copious amounts of creamy yellow pus were evacuated. No amebae or other parasites were seen on direct smear of the pus, and culture gave a pure growth of hemolytic staphylococcus aureus. It seemed probable, therefore, that the abscess was embolic from some septic focus elsewhere, the most likely source being the severe hordeolum just prior to the onset of his illness.

The patient made a very good postoperative recovery. His temperature fell promptly to normal, his strength and appetite began to return and his weight started to climb. By the end of 3 weeks he was up and about.

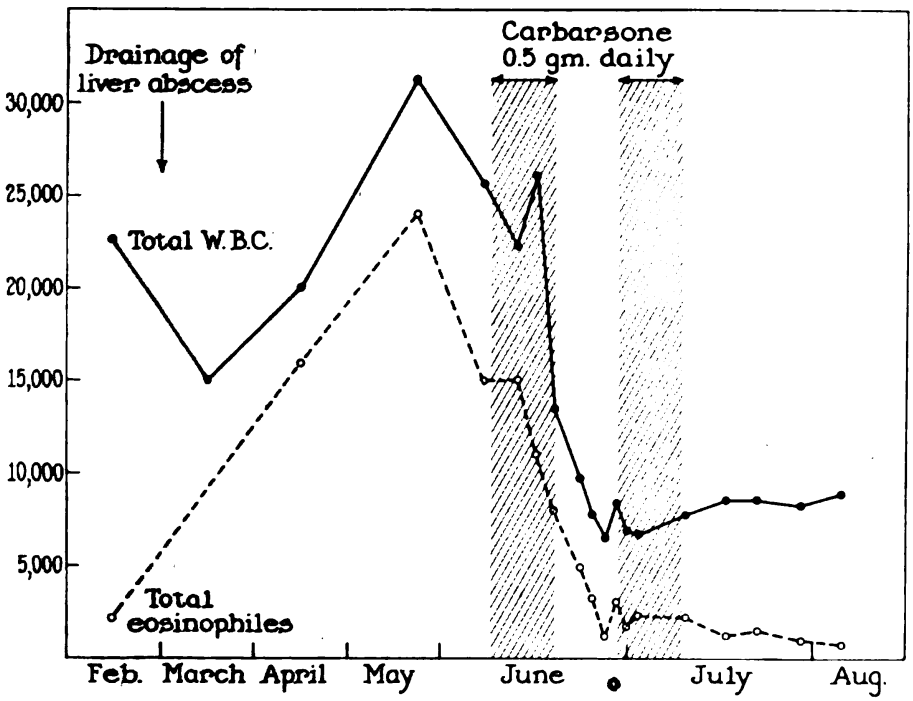
As will be seen in figure 1, however, the white count after an initial postoperative fall began to rise again about 2 weeks after the operation. This rise in total

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white count was apparently due entirely to an extraordinary increase in the number of circulating eosinophils which rose rapidly to 80 percent of the total number of white cells.

About 6 weeks postoperatively the patient's improvement reached a plateau and he began to notice once more increasing weakness and fatigue. At the same time there was a return of his asthmatic attacks, occurring usually between 2 and 5 A. M. They were not severe and easily controlled by ephedrine. He remained afebrile and without any localizing signs or symptoms other than the asthma.

Two months postoperatively the patient was sent home to convalesce. Instead of getting better, however, he became more and more tired, weak, and listless. His appetite failed and he began to lose weight again. The asthma became increasingly severe, requiring epinephrine for relief on two occasions and he had a severe, dry, hacking morning cough. On his return from leave, therefore, he was sent back to the civilian hospital for further study.



1. Effect of the administration of carbarsone on the total number of circulating white cells and eosinophils in a patient with tropical eosinophilia.

Physical examination at the time of his second admission, 20 May 1943, showed that he was still markedly underweight and somewhat weak and tired but not acutely ill. The temperature was normal. The only abnormal physical signs were found in the lungs, which were resonant throughout but filled with coarse moist râles and sibilant and sonorous rhonchi. The spleen was not palpable. The recent operative wound was well healed and there was only slight tenderness on percussion over the former site of the liver abscess.

The only significant laboratory findings were the total white count of 32,500, 78 percent of which was accounted for by eosinophils, and the x-ray of the chest. This showed the same fine irregular diffuse mottling, still faint, but more prominent than in the film taken 3 months previously. The small, poorly defined areas of increased density were scattered diffusely throughout both lung fields but more thickly in the hilar regions and at the bases. Examination of the blood,

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stools, and sputum for parasites or significant organisms was negative, including a noctural blood smear for filaria. A complement-fixation test with trichinella antigen was positive in a dilution of 1:380, but this was considered too low to indicate an active infection.

The patient remained afebrile but his symptoms of weakness, fatigue, and poor appetite persisted and he continued to lose weight, to have mild attacks of asthmatic breathing almost nightly and a severe dry cough every morning productive of a small amount of thick white sputum. Examination of the paranasal sinuses revealed no evidence of infection. Bromsulfalein and hippuric acid excretion tests of liver function were normal and a surgical consultant could find no evidence indicating a recurrence of the liver abscess. He was put in an air-conditioned room and given an elimination diet in an effort to eradicate the asthmatic attacks. Although these were relieved, numerous coarse râles and rhonchi continued to be present throughout both lungs. Th total white count fell to 22,000 but the eosinophils remained between 60 and 75 percent.

At this point the patient's father-in-law, a physician, called our attention to Weingarten's recent description of so-called "tropical eosinophilia." It at once became apparent that our patient fitted this description in every detail.

Accordingly a therapeutic test of arsenic was decided upon. On 8 June 1943, the patient was started on carbarsone by mouth, 0.25 gm. twice daily and after a rest period of 10 days a second 10-day course was given. As shown in figure 1, there occurred the characteristic slight rise in total white count in the middle of the first course of arsenic although there was no corresponding rise in eosinophils. At the end of the first 10-day period there was a sudden drop in the white count, which had been over 20,000 for 2 months, from 26,000 to 9,800 in 4 days. This sudden fall was due almost entirely to the decrease of eosinophils in the blood, since up to this point they still made up 50 percent of the total white count. Thereafter, however, the total white count leveled off at normal values, whereas the number of eosinophils continued to fall to 16 percent of the total. Following the second course of arsenic there was a further fall to a final percentage of 9.

Soon after the first course of arsenic was begun the chest became clear to auscultation. By the end of this course the patient was already showing improvement in his strength, appetite, and general sense of well being. The cough disappeared, he began to gain weight and there was a very definite clearing of the abnormal x-ray findings in the chest.

His improvement continued throughout the second course of arsenic and 6 weeks after therapy was begun he was recommended for limited duty.

DISCUSSION

It seems probable that this man acquired his disease during his stay in India but that it remained latent until his powers of resistance were diminished by a severe intercurrent infection. Finally, when he had sufficiently recovered from the more severe symptoms of his liver abscess it became possible to recognize the milder signs of tropical eosinophilia.

With increasing contact between the United States and India it is likely that more cases of tropical eosinophilia will turn up in this country. Furthermore, since little is known of its etiology, epidemi-

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ology, or total geographical distribution, there is no reason to think that it may not be widespread in tropical climates. It should, therefore, be considered in the differential diagnosis of any case exhibiting a high degree of eosinophilia, particularly since there appears to be a specific cure.

In spite of the failure thus far to find an etiologic agent, the remarkable therapeutic effect of arsenic points toward a spirochetal or protozoan infection of some sort. The fact that oral treatment is as effective as intravenous suggests that the gastro-intestinal tract is the chief locus of the infection, although this is by no means certain since a considerable amount of ingested arsenic may be absorbed. Further efforts must be made to discover the etiology in areas where the disease is more prevalent.

SUMMARY

A newly recognized endemic disease occurring in the coastal regions of India and characterized by a chronic cough, asthmatic attacks, weight loss, weakness and an extreme degree of eosinophilia, has recently been described by Weingarten and named by him "tropical eosinophilia." The etiology of the disease is thus far unknown, but the administration of arsenicals, either orally or intravenously, brings about a dramatic cure.

A case is reported wherein all the typical signs and symptoms appeared 8 months after the patient had returned from India to the United States. A rapid disappearance of all evidence of the disease followed the oral administration of carbarsone.

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WAR-INDUCED EYE INJURIES[1]

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Consideration of war-induced eye injuries seems to be of paramount interest and importance at this time for several reasons. The paucity of recent scientific articles dealing with this subject is well known. The holocaust at Pearl Harbor 7 December 1941 at which time many of us rendered service, resulted in more than one-half the casualties suffered by the naval forces during the entire first year of wartime operations, producing a large number of eye injuries. Types of injuries then and subsequently sustained were both the usual and uncommon forms, prompting the recommendation that henceforth "blast injuries" (*1*) shall be included in the Navy nomenclature of injuries.

Inasmuch as the possibility of eye injuries in the present conflict is greatly increased over previous campaigns, and immediate, careful treatment and supervision is of paramount importance, it is felt that a brief summary of commoner types and the emergency treatment of them would be of benefit to the Navy doctor not specially trained in ophthalmology.

The statistics of eye injuries in the United States Navy in a typical year of peacetime operations gave approximately the following percentages (*2*):

	Percent
Foreign body, traumatic, eye	29
Contusion, eye	25
Wound, lacerated, eye	18
Burn, chemical, eye	9
Ophthalmia, actinic rays	7
Burn, eye	4
Hemorrhage, traumatic into eyeball Wound, punctured, eye Rupture, traumatic, eye	3
Wound, incised, eye	2
All others	2

Naturally, the types and percentages of eye injuries will vary during wartime operations with probable emphasis upon foreign bodies, contusions, and lacerations.

Space allotted for this article does not allow elaboration upon multiple complications, but will deal chiefly with immediate findings and measures.

[1] Read before the Honolulu County Medical Society.

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The all important aftercare likewise must be considered largely elsewhere. However, the whole course of treatment is greatly influenced by immediate application of medical and surgical measures as indicated for each individual case. An increase is anticipated in both the relative number and severity of eye injuries during wartime operations. On the other hand a decrease (relative) of the number of those suffering permanent disability is not unlikely and is to be hoped for.

BURNS OF THE EYELIDS.

These are usually first or second degree and are more frequent on the upper lid. Etiologic agents are fire, hot metals, hot ashes, and chemicals, which are usually intense and instant in action, often associated with burns inflicted elsewhere. Very early consideration of the following is indicated:

1. Relief of pain.
2. Prevention of further contamination.
3. Combating shock.
4. Measures to promote healing.
5. Measures to combat fluid loss.
6. Measures to insure a minimum of scarring.

Administering of ¼ to ½ grain of morphine sulfate in severe burns (preferably in Syrettes) is most effective. All loose tissues, charred masses, burned cilia, especially when in-turned, are removed and a detergent is used for oil eradication. Blisters are opened as a rule and as far as possible asepsis is employed. The surrounding areas are thoroughly cleansed with soap and sterile water, and may be lightly irrigated by a bulb syringe on the burned areas. No scrubbing of the burned areas is allowed. Butyn ointment 2 percent, and 5 percent sulfanilamide ointment are applied and the area covered with sterile gauze. Tetanus toxoid (½ cc.) may be given at the discretion of the physician.

When shock is imminent, plasma may be administered intravenously as it is superior to whole blood in burn cases. Replacement of fluid is readily done by intravenous administration of 5 to 20 percent dextrose in distilled water.

FOREIGN BODIES OF THE EYE, EXTRA-BULBAR.

These are usually metallic, but may be dirt, carbon, stone, glass, or splinters, frequently acting as vehicles to transmit infectious material. Those rather superficial may be detected macroscopically, often aided by a binocular loupe. Deeper ones may be detected by a metallic probe, or better still by x-ray, the method always employed when in doubt. Ordinarily foreign bodies in the lids or deeper structures do

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not demand emergency removal, but, as in deep lacerations or other puncture wounds, do require 1,500 to 3,000 units of tetanus antitoxin if an individual failed to have an immunizing dose, or ½ to 1 cc. of tetanus toxoid when previously immunized. In addition to removal of the foreign body with a minimum of trauma, sterile sulfanilamide should be insufflated in the thoroughly cleansed wound, 30 grains of sulfadiazine or sulfathiazole should be administered orally and 15 grains every 4 hours for 24 to 48 hours, or as required.

Frequently foreign bodies lodge and become embedded on the tarsal surface causing severe irritation and discomfort. After 2 percent butyn instillation, the eyelid should always be everted and thoroughly examined. When present, foreign bodies are readily detected and removed.

In multiple injuries, or in any case in which shrapnel or other metals are suspected to be the offending agent, x-ray of both orbital and extra-orbital tissues is indicated. When present, removal of all or in part is elective rather than emergency, depending upon the location, upon whether untoward signs or symptoms are produced, and upon the general condition of the patient. Removal of a foreign body which has lodged about the optic nerve is undertaken only after mature calm and careful consideration, as any undue tension upon the nerve is accompanied with irreparable loss of function and greater probability of complications.

LACERATIONS OF THE EYELIDS.

These vary in gravity depending upon the size, depth, location, direction of the laceration and extent of tissue damage. They demand early expert care to prevent infection, deformity and impairment of function.

Horizontal lacerations are approximated relatively easily and heal with little deformity. Vertical wounds are prone to separate widely, particularly when severing the orbicularis muscle, and require a far greater number of deep catgut sutures and No. 00 or No. 000 silk sutures externally. Sterile sulfanilamide powder should be insufflated deeply. Externally the sutures should coapt the edges with exactness but without tension. In general, the sooner the repair is made following injury the more satisfactory the result, cosmetic and functional. Subsequent rest in bed with both eyes covered is to be recommended.

INJURIES OF THE ADNEXA.

Here cleanly incised wounds and contusions give far less concern than lacerations or burns. Injuries may result from direct or indirect violence, the most important ones interfering with the flow of tears from the puncta to the nasal opening of the lacrimal duct.

A cleanly incised wound involving the canaliculus may be repaired

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with a fair chance of good functional result. The puncta, lying in a vertical line, serves as a guide. Horner (*3*) advocates probing, using No. 3 Bowman probes to search out the canaliculus. The probe is left in situ several days as the tissues are expertly coapted. Binocular dressings are used after any extensive attempts at repair.

When foreign bodies and fractures are present, causing deformity, interfering with function, or predisposing to infection, they should command attention prior to surgery.

CONJUNCTIVAL INJURIES.

Trauma of the conjunctiva may cause considerable chemosis and subconjunctival hemorrhage, causing more discomfort and distortion than pain, and rarely necessitating more than local therapy.

Lacerations of the conjunctiva heal readily. When extensive, sutures should be used which are usually removed in 24 to 48 hours. One should be alert to employ x-ray to detect foreign bodies when tissue injury or hemorrhage will not allow complete examination.

Burns of the conjunctiva should receive special attention, due to the possibility of immediate or remote pathology. Causes are actinic rays, molten metals, fire, explosives and chemicals. Signs may vary from a simple inflammation to intense chemosis, or a membrane may become apparent from extensive tissue damage. The pain is instant and severe depending upon varying factors, such as the type of irritant, its concentration, the amount entering the eye, time and thoroughness of removal, and type of medication used. Immediate copious irrigation with saturated boric acid solution or normal saline is usually a good cleansing and remedial procedure. Alkaline solution should be used if the irritant is known to be acidic. Those solutions should be readily accessible and used instantly; vacillation is here an inexcusable folly.

Burns by acids are usually less severe and leave less permanent damage than alkalies, due to the precipitating action on the proteins by acids. Acid burns and those produced by lewisite or mustard should be thoroughly irrigated with 2 percent bicarbonate of soda solution. Saturated boric acid solution should be used for alkaline burns, keeping in mind that the penetration is greater than at first is apparent, with less likelihood of a favorable outcome.

Two percent fluorescein and 2 percent butyn solutions should be instilled for examination and control of pain followed by 2 percent atropine ointment to put the iris at rest in severely burned cases.

Cold compresses are helpful, applied at intervals for the first 24 to 48 hours. In severe burns, 1 percent pontocaine ointment may be used at the first dressing. To prevent symblepharon, the lids should be separated at least twice daily and a large amount of boric ointment

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or mineral oil inserted between the lids. Later 10 percent cod-liver ointment may hasten recovery. Both eyes are covered with gauze and the patient is cautioned against forcibly contracting the lids.

Foreign bodies of the conjunctiva are usually removed by a spud or forceps. However, when they penetrate and are attended with hemorrhage, they are elusive and require great patience and dexterity. Removal by a magnet is indicated in those which are electropositive.

INJURIES TO THE BONY ORBIT.

Etiology may be direct or indirect trauma. Diagnosis may be made by inspection, employment of the sense of touch, employment of x-ray and observance of function or muscle abnormalities.

There may be edema, hemorrhage, nerve paralysis, or emphysema when an open wound extends into the nasal cavity. If there is likely to be a fracture extending into the nasal cavity, the first measure is to caution the patient not to blow the nose, for such might cause spread of infection and emphysema. A well executed x-ray study is indicated to determine the extent of damage, amount and direction of bony displacement, and the presence of a foreign body. In general, the sooner the bones are manipulated into proper alinement the better the prospect for the restoration of function with a minimum of deformity. When foreign bodies are detected, localized and accessible, and removal is decided upon, this should precede bone manipulation and surgery. One-half to 1 cc. of tetanus toxoid and gas bacillus antitoxin is administered as indicated in all deep, open wounds, and 30 to 60 grains of sulfadiazine are given by mouth. Sulfanilamide powder should be insufflated into the wound freely.

CORNEAL INJURIES.

Corneal burns have much the same etiology and treatment as stated for the conjunctival burns, but the prognosis, particularly in alkaline burns, is less favorable, due to the probability of impairment of vision.

Foreign bodies of the cornea are frequently embedded. Instillation of 2 percent butyn or holocaine produces adequate anesthesia without corneal injury, facilitating examination and removal. In every case of suspected foreign body or nonperforating injury, the cornea should be stained with fluorescein which is alkalinized with 3 percent bicarbonate of soda, thereby staining any damaged epithelium a brilliant green. Ordinarily the foreign body is removed early, with a spud. A binocular loupe is a distinct aid and should be used when available to avoid traumatizing the cornea. When there are multiple foreign bodies deeply embedded, particularly when other serious injuries coexist, they need not all be removed the first day. Indeed some may never require removal. The cornea and conjunctiva

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should be thoroughly irrigated with warm normal saline solution. Equal amounts of 1 percent pontocaine and 5 percent sulfanilamide ointment should be inserted between the lids. The patient is instructed to look down as the upper lid is pulled out and down to enclose the ointment, and the patient is instructed not to contract the lids forcibly. Both eyes are covered with sterile gauze. In the case of very deep foreign bodies, atropine 1 to 2 percent may be inserted between the lids daily as required.

PERFORATING WOUNDS OF THE CORNEA AND SCLERA.

These are always of serious import due to likelihood of infection, lens and retina injury, and impairment of function. They vary in severity and degree, depending upon the size, site, nature of the perforation, and whether a foreign body has been retained.

When perforation is suspected, spasmodic closure of the lids is likely to ensue, resulting in perilous loss of vitreous humour. The injection of 2 to 4 percent novocain in the orbicularis muscle is indicated, followed by 2 percent butyn instillation. If there are contraindications to the injection of the muscle, a somewhat less effective control of blepharospasm may be achieved by facial nerve injections, either at the stylomastoid foremen or at the parotid plexus.

Foreign bodies should be ruled out by x-ray, the areas cleaned with sterile normal saline or boric solution, and a careful search made for pathologic changes.

A large perforating injury of the globe is easily recognized. The eyeball becomes soft, as aqueous or vitreous escapes. The anterior chamber becomes shallow in extensive perforation of the cornea, deeper in scleral rupture or perforation, and function is always impaired.

Protruding iris or vitreous is always cut off flush and sutures may be necessary in the cornea or sclera. A conjunctival flap is pulled over the affected area of the cornea. Atropine is instilled and ½ to 1 cc. tetanus toxoid administered. Thirty to 60 grains of sulfadiazine are given by mouth. Sulfanilamide may be applied locally in the wounds. An eye hopelessly injured may be removed at once or within a few days at the discretion of the surgeon.

FOREIGN BODIES, INTRA-OCULAR.

These are always of major importance and are never well retained. There is often loss of substance (aqueous, lens, vitreous and blood), with severe vision impairment, or loss of the eye itself. Prognosis, except for those in the anterior chamber, is not favorable. X-rays are to be employed for detection and localization, even in cases where a foreign body is clearly visible with the ophthalmoscope.

Foreign bodies in the anterior chamber at times may be removed

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through the perforation, or a keratotomy may be done over the foreign body when it has migrated a considerable distance or becomes enmeshed in the iris. The electromagnet is employed when possible. Non-magnetic foreign bodies are removed with forceps. The anterior chamber may be irrigated with sterile normal saline solution; corneal sutures and conjunctival flaps may be necessary.

Those in the vitreous sometimes are removed through the site of entry. When impossible to extract them in such an area, the site of choice for a sclerotomy is just behind the ciliary body where there is less likelihood for retinal detachment. After suturing the sclera, treat as noted above for perforating injury. After 2 weeks, if circumcorneal injection and other untoward signs are present, enucleation is advisable to prevent sympathetic ophthalmia.

CONTUSIONS OF THE GLOBE.

These arise from direct or indirect trauma, such as blast injuries, foreign bodies, blow upon the head, fractures, etc. A mild inflammation, or immediate or remote visual disturbances, may be the only findings. But anyone suffering such an injury should be subjected to a thorough eye examination, noting any pupil, muscle, fundus or tension abnormalities. An accurate record should be kept, including field studies. Traumatic miosis may be present. Others may have mydriasis.

In traumatic mydriasis, the pupil is irregularly dilated, practically immobile due to parasympathetic nerve injury, and symptoms are usually vague. The condition subsides, usually without complications, but the pupil may remain dilated permanently. Treatment by 1 to 2 percent atropine is indicated when tension is normal.

In commotio retinae there is an intense retinal edema about the macula interfering with central vision. Treatment consists of rest in bed with both eyes covered, instillation of atropine 1 to 2 percent, particularly when ciliary injection is present, with repeated fundus and field examinations, searching for retinal tears, hemorrhage, etc.

Iridodialysis, a condition arising when the iris is forced from its attachment to the ciliary body, thereby exposing the suspensory ligament and fundus, may give little concern when the opening is small. Spontaneous reattachment has been reported (*4*) but is extremely rare. When small, rest and bandage of both eyes is employed. When rupture is extensive, the pupil appears as a slit, hyphemia is usually present and surgery may become necessary to secure reattachment. Sympathetic ophthalmia must be watched for. A large amount of blood in the anterior chamber may at times be removed by paracentesis of the cornea and irrigation with normal saline solution. Usually, even a large amount of blood in the anterior chamber is absorbed without interference.

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Ciliary muscle spasm may occur following a contusion, in which case the individual has artificially induced myopia. Relaxation is induced by atropine instillations.

Traumatic glaucoma is not a common finding but does occur. This is usually due to a direct impact upon the globe. It is believed to be due to a neurovascular reaction, characterized by sudden and unstable rise in tension, usually within a few hours or days subsequent to injury. Blurred vision, eye pain and discomfort and markedly altered depth perception are complained of, while signs are a dilatation of the pupil, deep ciliary injection and lacrimation. The pupil does not react to light or accommodation. The fundus appears normal, while field changes are not altered appreciably. As a rule the condition subsides on rest and miotics, such as 1 percent eserine or pilocarpine instillations. Frequent tonometer readings are indicated.

Rupture of the lens capsule after a blow upon the globe always is a serious complication and requires surgery to restore vision. If only a slight defect is produced, a slowly developing cataract may not demand immediate attention. But if lens substance is forced out, operation and lens removal should be immediate.

Extensive intra-ocular hemorrhage into the vitreous is often accompanied or followed by retinal detachment. These hemorrhages may result from rupture of retinal vessels, choroid, ciliary body and the sclera, and while they are always severe complications, they are usually absorbed without complete loss of function. Bedrest, cold compresses, atropine instillations when tension will allow it, and the institution of general measures as required, are the best forms of therapy.

REMINDERS

1. To cope successfully with severe eye injuries, carefully observe, weigh the complaints, and prescribe within the shortest reaction time commensurate with sound judgment.
2. Never neglect adequate eye examinations, intra- and extra-ocularly, and proper treatment of shock.
3. Have adequate sterile solutions and supplies immediately available to cope with any emergency.
4. Go "all out" for conservation of vision. Don't vacillate. Keep ahead of infection by prescribing never too little and never too late.

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GLYCOSURIA WITH DIABETIC TYPE OF GLUCOSE TOLERANCE CURVES IN OBESE NONDIABETICS

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During the months of November and December of 1942, 4 patients were admitted to the hospital as a result of the finding of glycosuria at routine examinations. These men were naval officers, 3 of whom were over 47 years of age, and glycosuria had been noted at their annual physical examination. The fourth, 23 years old, had had numerous examinations done a month preceding the promotion examination, at which time his glycosuria was first noted. He had been moreover under constant medical surveillance as a result of an abdominal wound sustained in combat.

There were several features which these patients all shared in common: First, they were all regular line officers who had had, therefore, frequent examinations in the past; second, none of them had a family history of diabetes; third, only one had had any symptoms of diabetes; and fourth, they were all overweight, their weight being 15 to 50 pounds above the ideal weight according to tables compiled by Fisk (*1*).

Coincident with the admission of these patients, there appeared in the literature an article (*2*) in which was described and analyzed a group of obese people with glycosuria whose glucose tolerance curves were of the diabetic type. With reduction in weight to within the normal range, it was found that the sugar tolerance curves returned to normal. The criteria were not only rigid as regarding the weight that should be reached by these patients but also regarding the preparation for their glucose tolerance tests. The patients were placed on a diet containing 300 gm. of carbohydrate, 80 gm. of protein and approximately maintenance calories made up in fat, for 3 or more days before the test was performed. The glucose tolerance test was performed in the usual manner giving 1¾ gm. of glucose per kilogram of ideal body weight.

Our procedure, unless otherwise stated, was to use the Exton-Rose modification of the glucose tolerance test (*3*) without any specific diet. If this test was normal, the patient was placed on the special diet noted above, and a glucose tolerance test using 1¾ gm. of glucose per kilogram of body weight was done 4 days later.

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Newburgh (*2*) followed 12 patients for a period of 6 to 29 months and they still had normal glucose tolerance curves at the end of this time in spite of a mixed diet. Criticism perhaps can be raised as to whether these individuals are not really potential diabetics. These factors and their various possibilities are discussed in detail in his article. However, from a practical standpoint, especially as pertaining to naval personnel, this is of little importance. The main question to be answered is whether these patients have active diabetes, and whether they are fit for duty, or can be fitted for duty.

Consequently a drastic weight reduction regime on the 4 patients of our series was instituted. Two of these patients with a loss of 30 to 40 pounds in weight had a normal glucose tolerance test on discharge and were considered fit for duty. The other 2 continued to have the established glucose tolerance curve for diabetes in spite of their weight reduction, and eventually appeared before a board of medical survey with this diagnosis.

Because of the serious implications of an established diagnosis of diabetes mellitus particularly in naval personnel, attention is directed to this abnormality of carbohydrate metabolism. The condition may well mask itself as active diabetes mellitus and would have undoubtedly caused a recommendation for retirement of two of these valuable officers if the weight reduction program as recommended by Newburgh had not been followed.

CASE REPORTS

Case 1.—Age 50 years, weight 235½, ideal weight 178; glycosuria and diabetic glucose tolerance curve returned to normal with weight loss of 45 pounds.

This officer was admitted 21 December 1942 as the result of an annual physical examination at which several different urine examinations revealed varying amounts of reducing substance. The glucose tolerance curve (Exton-Rose) was as follows: Control 130 mg. percent; ½ hour 198; 1 hour 256; 2 hours 238. There was no history of a recent infection and his weight had been constant for 10 years. He had had no symptoms of diabetes mellitus and there was no familial history of this disease. He was placed on a diet of 800 to 1,000 calories a day with vitamin supplements. During a period of 6 weeks he lost about 45 pounds in weight. On 5 January 1943, his weight was 220 pounds, and the glucose tolerance test was: Control 106 mg. percent; ½ hour 124; 1 hour 220; 2 hours 134. Two weeks later with another 10 or 12 pounds lost the figures were: Control 101 mg. percent; ½ hour 184; 1 hour 154; 2 hours 115. On 25 January 1943 he was given a glucose tolerance test in which there was one dose of sugar (100 gm.) and the figures were: Control 83 mg. percent; ½ hour 100; 1 hour 98; 2 hours 131; 3 hours 115. On 2 February 1943, weight about 190, he was placed on a diet containing 300 gm. of carbohydrate, 80 gm. of protein, and sufficient fat to make the diet a total of 2,400 calories. On 6 February the glucose tolerance test using 1¾ gm. of glucose per kilogram of ideal weight was: Control 107 mg. percent; ½ hour 120; 1 hour 111; 2 hours 136; 3 hours 100. He was surveyed as fit for duty with a diagnosis of glycosuria.

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Case 2.—Age 55 years, weight 247, ideal weight 180; glycosuria and diabetic glucose tolerance curve returned to normal with loss of 40 pounds in weight.

This officer was admitted 25 November 1942 following the finding on three different occasions of reducing substances in the urine (3-plus) at an annual physical examination. The glucose tolerance curve (Exton-Rose) was: Control 127 mg. percent; ½ hour 160; 1 hour 196; 2 hours 171. He had always been in good health but had been overweight for many years. There were no symptoms of diabetes and no familial history of this condition. He had several moderately infected teeth which were removed during period of observation. He was placed on a diet of 600 to 1,000 calories with vitamin supplements. On 22 December 1942 (weight 235 pounds) the glucose tolerance test was: Control 138 mg. percent; ½ hour 174; 1 hour 267; 2 hours 215. On 2 February 1943 (weight 210) control 97 mg. percent; ½ hour 133; 1 hour 150; 2 hours 140. On 28 February 1943 he was placed on a 2,400 calorie diet (carbohydrate 300 gm., protein 80 gm., fat to 2,400) for 4 days and was given a glucose tolerance test, the initial dose being 136 gm. of glucose (1¾ gm. per kilogram of ideal weight) and the figures were as follows: Control 100 mg. percent; ½ hour 144; 1 hour 167; 2 hours 132; 3 hours 114. He was still considerably overweight at this time and continued weight reduction for another month. He was surveyed as fit for duty, with the diagnosis of glycosuria.

Case 3.—Age 23 years, 15 pounds overweight; diabetic glucose tolerance curve-weight reduction caused no real change.

This officer was admitted 14 December 1942 because of glycosuria found at time of a promotion physical examination. Several urine examinations had been normal in the previous 2 months, during which time he had been invalided because of an abdominal wall laceration. He had gained 15 to 20 pounds in 18 months. Glucose tolerance test was: Control 130 mg. percent; ½ hour 240; 1 hour 400; 2 hours 324. Placed on diet of 1,000 calories or less and never had glycosuria while here. By 20 January 1943 he had lost 10 pounds. Glucose tolerance test was: Control 97 mg. percent; ½ hour 167; 1 hour 227; 2 hours 214. On 9 March 1943 weight was ideal. Glucose tolerance test was: Control 92 mg. percent; ½ hour 170; 1 hour 229; 2 hours 199. He appeared before a board of medical survey with the diagnosis of diabetes mellitus and was recommended for sick leave.

Case 4.—Age 49 years, weight 225 pounds, 45 pounds overweight; diabetic glucose tolerance curve which did not return to normal with 35 pounds weight loss.

This officer was admitted 9 November 1942 because of glycosuria found on several occasions at annual physical examination. Glucose tolerance test was: Control 125 mg. percent; ½ hour 230; 1 hour 220; 2 hours 214. Placed on 800 calorie diet. On 12 January 1943 his weight was 200 pounds; glucose tolerance test: Control 117 mg. percent; ½ hour 300; 1 hour 236; 2 hours 174. On 8 February 1943 (weight 190) the glucose tolerance was: Control 101; ½ hour 143; 1 hour 197; 2 hours 99. The diagnosis established was diabetes mellitus and the patient was recommended for retirement by a board of medical survey.

CONCLUSIONS AND SUMMARY

1. Four patients with glycosuria and obesity are described. Two of these patients with marked weight reduction had their glucose tolerance test return to normal levels, and no longer had any glycosuria.

2. These two patients fit into the group described by Newburgh.

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3. The importance of recognizing this group, particularly in naval personnel, is stressed.

4. It is suggested that before a diagnosis of diabetes mellitus is definitely established in an obese patient, especially if he be over 40 years of age, his weight should be reduced to the ideal figure for age and height, and that the definitive glucose tolerance test be delayed until that time.

5. It is to be noted that two of the three middle-aged "diabetics" were apparently cured by weight reduction. This is roughly the same percentage of cures effected by Newburgh. It is also worthy of note that the 23-year-old patient had a true diabetes and his glucose tolerance curve was not appreciably affected by weight reduction. This is in accord with the accepted teaching that glycosuria in the young is a more serious entity than when it first appears in middle life or old age.

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SULFONAMIDES IN COMMON COLDS

A study of 127 patients with upper respiratory infections was made. There were 75 cases that were treated symptomatically and 52 comparable cases that were in addition treated with sulfonamides.

It is apparent from the cases studied here that the use of chemotherapy as a routine in uncomplicated respiratory infections had no effect in altering the course of the disease. The hospital stay of the patients receiving chemotherapy was not shortened to any appreciable extent. The patients who did not receive chemotherapy recovered just as promptly as did those who received sulfonamide compounds and there was no evidence that the number of complications was increased in this group.

If chemotherapy has no effect in shortening the course of the disease or in preventing complications, there would seem to be no justification for its use in the common cold.—Kauvar, A. J., and Mount, F. R.: Effect of sulfonamide therapy on the common cold. J. Kansas M. Soc. 44: 290–293, September 1943.

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PARADOXICAL RESPIRATION

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Any procedure which necessitates the more or less extensive mobilization of the thoracic wall may be followed by profound changes in the hemo-respiratory physiology of the individual. Often, these changes occur with such dramatic suddenness that failure to act promptly and correctly may readily prove disastrous. Fortunately, due to a better understanding of thoracic physiology, serious degrees of respiratory distress are met with less frequently in chest surgery. The added factor of war injuries of the thorax, however, warrants serious consideration of that type of respiratory derangement known as "paradoxical respiration," because it is responsible for a definite mortality.

There are several methods by which an extensive loss of rib cage rigidity may be brought about. Surgically, a debridement may require the resection of a number of costal segments. Therapeutically, also, extensive costal resection may be required to effect the obliteration of a chronic empyema sac. More important at present is the mobilization of the chest wall due to trauma, the caved-in chest following a crushing injury. On board ship it may result from gun recoil. The traumatic type is frequently associated with underlying visceral damage.

An understanding of the pathologic-physiology involved is essential if intelligent treatment is to be carried out. Clinically, there is noted a complete reversal of the normal respiratory movements on the affected side associated with dyspnea of varying intensity. This phenomenon of paradoxical respiration is characterized by a combined retraction of the lung and overlying flaccid chest wall during inspiration, and expansion of these structures during expiration. Coryllos [1] has claimed that the diaphragm also moves paradoxically. The patient exhibits a varying degree of respiratory distress and appears apprehensive. The pulse and respirations are accelerated. The intensity of the phenomenon is dependent upon certain factors. It is generally stated that the condition is due to the partial removal of the bony support of the chest wall. This structure, being deprived of its rigidity, is drawn inward during inspiration as the intrapleural pressures become more negative. Coryllos maintained that the mere

[1] Coryllos, P. N.: The Surgery of Pulmonary Tuberculosis. Comet Press, Inc., Brooklyn, N. Y., 1937.

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resection of three ribs could not entirely explain the intensity of the paradoxical motion. From his observations, he concluded that it was due not only to the loss of chest wall rigidity but also to the retention of bronchial secretions in the involved side resulting in bronchial or bronchiolar obstruction.

Careful studies at operation and throughout the postoperative period indicate that there are other factors to be considered. Like the problem of shock, one may observe initiating, contributing and sustaining factors. Obviously enough, no paradoxical motion can occur in the presence of an intact rib cage. A contributing factor is the status of the underlying lung and pleurae. If there be decreased lung elasticity and the underlying pleurae thickened or adherent from previous disease, the degree of paradoxical motion will be considerably less. This fact has been repeatedly observed at operation. The patient exhibits only mild dyspnea and is promptly relieved by oxygen therapy and the application of a three- to five-pound shot bag to the involved side. If, however, costal resection is carried out over more normal areas of lung and pleurae, paradoxical motion suddenly becomes increased. This explains partly the greater incidence of this complication during and following a second stage thoracoplasty in which long segments of the fourth, fifth and perhaps the sixth ribs are resected. One does not often see any marked evidence of it after the removal of the upper two or three ribs unless, as stated, resection is carried far anteriorly over the normal lung area. The absence of any appreciable paradoxical motion in the upper thorax may be explained by the fact that there is normally relatively little motion in the lung apex. In addition, there is adequate support of the weakened chest wall by the overlying scapula and heavy back muscles. The serosanguineous fluid which fills the extra-pleural dead space also tends to minimize the degree of movement.

Another contributing factor is the status of the mediastinum. In the presence of a fixed mediastinum such as is found in long standing empyemata, paradoxical motion is minimal. The resection of four, five or more ribs under these circumstances can be done with little or no derangement of the hemo-respiratory mechanism. A highly mobile mediastinum, on the other hand, proportionately increases the abnormal motion. Encroachment on the opposite lung more rapidly hampers its inflation and expansion, thus severely cutting down the patient's vital capacity. These patients exhibit marked dyspnea and rapidly become cyanotic. They gasp for air. The pulse is rapid and weak. Blood pressure falls rapidly. In short, a picture of severe anoxia of the anoxic type is clearly evident. Oxygen therapy

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alone, even in high concentrations, will not suffice unless some means of stabilizing the flaccid chest wall is carried out. During this dangerous phase, the cough mechanism is impaired or completely absent. The patient is exhausted and cannot cough effectively to rid himself of accumulating secretions. Once bronchial stasis and retention occurs, the paradoxical motion becomes greatly intensified. This explains why a mild degree may become more pronounced later in the postoperative period. In short, it becomes a definite sustaining factor. Within a matter of minutes, the patient is in shock with coma supervening very rapidly. Death will follow unless prompt treatment is effectively instituted.

Much can be done in preventing severe degrees of the surgically induced type. The surgeon should limit the extent of costal resection especially if operating over relatively normal lung and pleurae. In debridement operations, he should desist the moment any degree of paradoxical motion becomes apparent. It is far safer to do multiple stage costal resections than to risk the dangers of paradoxical respiration. The administration of controlled breathing by the anesthetist is contraindicated in view of the possibility of temporarily concealing a dangerous degree of motion.

It will be noted that a good wound closure immediately lessens the severity of the paradoxical breathing. Following this, a firm adhesive strapping of the affected side should be done. Care must be taken not to increase the mediastinal displacement. By far the most important measure is the prevention of bronchial stasis with all its ensuing complications. In the presence of an adequate cough mechanism, the patient will respond nicely to the introduction of oxygen administered in high concentration by means of a face mask. The pain associated with intercostal nerve trauma must be relieved. Unless this is done, the patient cannot cough effectively. Care must be taken not to depress further the cough reflex by too heavy sedation. It is not an easy matter to estimate accurately the amount of sedation needed in all cases. In some cases of intractable pain it may be necessary to block the intercostal nerves with novocain.

If, for any reason, the patient is unable to cough effectively and there is evidence of accumulating secretions, every available means of securing bronchial drainage must be utilized. Bronchial aspirations must be carried out as often as the indication arises. Therefore, the aspirating equipment must be kept constantly at hand and a 24-hour watch maintained over the patient. With the prevention of bronchial stasis, one has only to await the gradual stiffening of the chest wall to secure complete arrest of the paradoxical motion. In some desperate cases, the transfer of the patient to a mechanical res-

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pirator has proved life-saving. Aspiration is done while the patient is in the respirator and is repeated as often as needed until voluntary cough becomes effective. As the chest wall gradually regains its rigidity, the patient's time in the respirator may be progressively shortened until he can be removed with safety. It would appear that this method should serve very well in treating the caved-in chest injury, especially if it be bilateral in nature. Lacking this equipment, one may resort to the use of perichondrial wire to grasp the flaccid area. This may then be brought up to an overhead frame and pulley arrangement. Tight adhesive strapping should be avoided for fear of increasing any underlying visceral damage.

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TWENTY-YEAR SURVIVAL OF BACILLUS PESTIS

A strain of Bacillus pestis which retained viability and virulence during 20 years of storage at 10° C. on the slanted surface of beef infusion agar tubes without transfer is reported. The strain P 4–7 was originally isolated from a California ground squirrel (Citellus beecheyi) at the plague laboratory of the United States Public Health Service in San Francisco, from which it was received December 11, 1922, at the National Institute of Health, in Washington, D. C. During 1923 and 1924 the strain was passed through guinea pigs every 2 or 3 months.

On April 23, 1943, the 48 tubes of the 1923 series were subcultured each to a horse meat infusion agar slant, of which 33 showed growth in 2 to 7 days, while 15 failed to grow. The growths from the 33 positive tubes were tested for virulence by injection, each into a guinea pig subcutaneously on the abdomen using a loopful of solid growth for each pig. * * * Six were killed for culturing when dying near the end of the first week and B. pestis was isolated from the heart blood of each. Their sites of inoculation, spleens, and inguinal glands showed typical gross lesions of acute plague and great numbers of B. pestis in smears.—Francis, E.: Twenty-year survival of virulent Bacillus pestis cultures without transfer. Pub. Health Rep. 58: 1379–1382, September 10, 1943.

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OSMOTIC RATE OF EXTRAVASCULAR FLUID

Following hemorrhage, fluid from the extravascular spaces migrated into the circulating plasma at the rate of about 0.25 cc. per kilogram of body weight per minute and about 22 minutes were required for approximate completion. The complete or partial restoration of blood pressure following hemorrhage is owing in part to this mechanism.—Essex, H. E.: Anesthesia in relation to shock. S. Clin. North America 23: 1212–1220, August 1943.

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STEEL WIRE SUTURES

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It is good military surgery to rehabilitate the fighting man in the most rapid manner. The early ambulation of postoperative patients is not only safe but is beneficial, as many surgeons can testify. The routine of the usual military hospital is very time-consuming and too often patients who have had simple appendectomies or herniorrhaphies will, according to custom and tradition, occupy much needed beds for weeks, and convalesce away from their duty for months. This is, in most instances, a waste of our manpower and our hospital facilities and is entirely unnecessary.

The advantages of early ambulation are appreciably great. Every one agrees that pulmonary and peripheral vascular complications are minimized in the active patient. A rapid turn-over makes available a relatively greater number of hospital beds. The morale of the patient does not deteriorate, as it surely does in long periods of convalescence. A patient aboard ship who knows that he can go over the side unaided in the event of a serious action is in a much healthier state of mind, than would otherwise be the case. The ambulant patient does not lose his muscular tone, nor does he get out of the swing of his usual routine and lose contact with his buddies. His mind does not have time to reflect on the morbid aspect of the war in general and himself in particular.

One may say that this is very well on board a ship where external hazards justify a hasty convalescence, but it is not the best type of surgical management for the large permanent hospital or the teaching institution. Early postoperative mobilization is not a dangerous concept to teach and practice under any conditions, and, moreover, it is unwise to teach any other practice to the junior medical officers who are training for the more active types of duty. They must know by experience and observation that the routine nonmilitary surgical patients can safely be out of bed within a day, and that it is highly desirable for the security of all concerned that they are.

The care of the early ambulant patient is very easy. An explanation of the purpose of this management, and an assurance of its safety, is rightfully due the patient, and his response will invariably be one of cooperation and confidence.

Pain in the operative area is surprisingly moderate, and can be controlled quite nicely by small but frequently administered doses of morphine. Active exercises in bed, such as turning about and flexing the thighs, are started as soon as the patient has recovered from the

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anesthetic and from the immediate shock of the operation. The evening of operation the patient can sit on the side of the bed, and stay there as long as he feels comfortable. This is facilitated by freeing the legs of restraining bedsheets, placing an arm under the shoulders and knees, and then boosting him up and around in such a manner that he is sitting on the side of the bed without having to strain or tense his abdominal muscles. He is encouraged to call for aid if he feels light-headed, since it is bad psychology for the patient to feel faint and helpless.

The next morning the patient is allowed to stand on the floor, and he is encouraged to walk to the bathroom. This is not only a stimulus to ambulation and recovery, but it also lessens the nursing load. A little later the patient will be spending most of his time in a chair. Minor changes in the temperature reaction of the ambulant patient are of no more significance than those of the bed patient. However, the up and about patient should be watched with as much care and attention as any bed case. The average patient who has had an appendectomy should be out of bed in 24 hours, discharged from the sickbay in 3 to 5 days, and returned to light duty in 1 week.

There are certain factors in surgical technic which make early ambulation possible, and a few of these, such as small muscle-splitting incisions, clean deft surgery, nonabsorbable sutures, and courage on the part of the surgeon, will be discussed in some detail.

Nonmilitary abdominal surgery should be done through muscle-splitting incisions whenever possible, since these incisions are easier to perform, require fewer sutures in their closure, and heal without weakness. The incision should be no larger than necessary. There is no need to make a 4-inch incision to remove a 2-inch appendix. This does not mean that the incision should be so small that the surgeon's speed and precision are embarrassed.

The actual surgery should be done with a minimum of trauma. Such practices as biting out necrotic bits of fascia with clamps merely for the operator's convenience in holding it, the careless use of towel clips, the forceful use of self-retaining retractors, the indiscriminate and excessive use of clamps to control capillary oozing of blood, the tying of suture knots with undue pressure, and other careless practices, are all to be condemned. The less a surgical incision is traumatized during an operation by biting at it, pinching it, and roughing it up, the faster and cleaner it will heal.

Suture material of 18–8 alloy stainless steel, first used by Dr. W. Wayne Babcock, has become increasingly more popular in the last few years. This material has many advantages, since it is nonabsorbable, nonelectrolytic, nonmagnetic, and nonallergic. It is well tolerated by almost every tissue of the body, and can be used as a

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single universal suture material. It is the ideal material for use in the presence of infection, since it cannot harbor or act as a focus for bacterial growth.

Tissues tolerate the material without demonstrable reaction, and heal without edema, thickening, or infiltration. Steel sutures are easy to work, and tying the knots with the needle holder permits a rapid, accurate technic. When the first knot is set, a precise suture tension is possible since the wire holds its form while the second knot is secured.

Fewer sutures are necessary with this material, since they are permanent, and their holding power constant and secure. There is an absence of delayed tissue swelling and edema, with its resulting suture strangulation, necrosis, and wound dehiscence. The material is low in cost and readily available. Fifty feet of steel wire costs approximately one penny. It is easily and absolutely sterilizable, and is nicely adapted to chemical sterilization, which is often necessary under battle conditions.

It has few disadvantages as a suture material, and even these can be overcome by using it correctly. The average surgeon is not familiar with its use, because of previous training, habit or prejudice, and tends to discard the material after a few trials because he is not adept in handling it. Suture ends must be cut so short that they will be "on the knot," so that the ends will not prick adjacent tissues. This does no real harm, but is annoying if the underside of the skin is so irritated. It can act as a foreign body if too large a gage is used as a running suture, and a draining sinus can result. Wire suture has a relatively great tensile strength and it is possible to strangulate or cut tissue with it if it is tied with brute strength. Tissues should be approximated only, and there is no excuse for tying any suture so tight that strangulation of the enclosed tissues results. The suture ends can prick and tear rubber gloves, unless the knots are tied with the needle holder. However, this may be an advantage since it serves to keep unnecessary fingers out of the wound.

This suture material is marketed in a variety of sizes, but the most useful gages are No. 35 and No. 32. The former is recommended for general use. It is used to ligate bleeding vessels of smaller caliber, as a continuous suture to close the peritoneum, to approximate light muscle and fascial layers in interrupted fashion, to buttress intestinal resections, close the subcutaneous tissue, and repair cutaneous wounds. The larger size, No. 32, is used as an interrupted suture whenever, in the opinion of the surgeon, a heavier and stronger suture is required.

It is used to close the abdomen in one layer if the surgeon so desires, to close the fascial layers in the heavy individuals, ligate larger caliber vessels, etc.

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The greatest advantage of steel suture material is that it insures n incisional security which, combined with good surgery, permits arly postoperative ambulation, which, in turn, lessens pulmonary nd peripheral vascular complications, promotes morale, increases ickbay facilities, conserves manpower, and protects patient per-onnel in the event of action.

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HEALTH AND TONSILLECTOMY

A feature of medical practice in recent years has been the popularity of tonsillectomy.

The data are based on the records of 909 girls, of whom 57 percent had had a tonsil-adenoid operation, compared with 43 percent in the earlier study. The physique of the girls who had undergone operation was similar to that of the girls who had not been operated on, and girls of exceptionally low weight and height and above the average were as common in the one group as in the other. Common colds were more frequent among the tonsillectomized than among the rest, the rates being 114 percent and 97 percent respectively. Influenza was also slightly more prevalent among the former group—43 percent, compared with 39 percent. Only a few cases of tonsillitis occurred during the 10 years, the tonsillectomized group having a slightly better record with a rate of 1 percent, compared with 5 percent for the other group. All other cases of sore throat were as frequent in the one group as in the other, the rates being 40 percent for those who had been operated on and 41 percent for the remainder. Susceptibility to the common infectious diseases of childhood was about the same in both groups, 26 percent of the tonsillectomized children and 24 percent of the others contracting these diseases. There was a considerable difference between the two groups for bronchitis, the rate among the tonsillectomized being 27 percent, while for the others it was only 16 percent.—Editorial: Health and tonsillectomy. Brit. M. J. 334, September 11, 1943.

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DEBRIDEMENT IN FACIAL INJURIES

Debridement in facial injuries must be extremely conservative. A few millimeters of tissue lost from the tip of the nose, the rim of the ear, the angle of the mouth, or the canthus of the eye, may mean painful and costly subsequent repair, permanent disfigurement, or both. Not one millimeter of potentially viable tissue should be sacrificed at the primary repair. Doubtful tissue should be treated as viable and every attempt made to conserve it by warm packs, supportive dressings and the avoidance of further traumatization by sutures.—Gurdin, M.: Special considerations in the repair of facial injuries. Hawaii M. J. 2: 199–200, March–April 1943.

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THE MANAGEMENT OF POST-TRAUMATIC EPILEPSY

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Among the ways in which head wounds of war differ from those of civil life is in the incidence of subsequent epilepsy. Statistical considerations strongly suggest that this is largely an expression of the extent of penetration of the calvaria by foreign bodies. Particular types of civilian wounds, such as depressed skull fracture, increase the incidence of later epilepsy to about 15 percent, but the development of this condition following all types of civil head wounds is considerably lower, running in general between 0.5 and 2 percent, not much higher than the incidence of epilepsy in the population at large. Elvidge (*1*) in a study of this disorder shortly following head injuries of various types found an incidence of 1.93 percent. A survey of epilepsy following war wounds of the head in World War I by Wagstaffe (*2*) disclosed its occurrence in 9.8 percent of cases. Where there was no dural penetration, the incidence was less than 2 percent, thus approximating the occurrence with civil wounds. In cases with dural penetration the incidence was 18.7 percent, and in those of dural penetration with brain damage 27.0 percent. As with tumors (*3*) the incidence appears to be greater with lesions closer to the rolandic zone.

Post-traumatic focal cerebral lesions are in general of an atrophic nature, the most common variety being that due to a cerebral or meningocerebral scar. Others include foreign bodies, leptomeningeal and porencephalic cysts, etc. The disorder also occurs following the development of a subdural hematoma, an example of an expanding epileptogenic lesion, but it appears probable that the epileptic manifestations in such instances are attributable to the underlying cerebral lesion rather than the hematoma per se. Penfield and Erickson (*3*) are of the belief that the focus for epileptic discharge in atrophic lesions is to be found in the zone where slow progressive destruction of gray matter is occurring and in which there is evidence of periodic closure of minute blood vessels sufficient to produce punctate injury or destruction.

Such studies, while suggesting the importance of an acquired factor in that form of epilepsy occurring after injury, should not be taken to mean that other factors are not operative in the causation of such seizures. Most formulations as to the pathogenesis of this disorder

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are in substantial agreement in postulating hereditary and precipitant factors as well. That the latter may be of an extracerebral nature is evidenced by the demonstration that a rise in the pH of the blood is associated with increased cortical excitability (*4*). Putnam and Merritt (*5*) have suggested that the stabilization of the cortical rhythm with various anticonvulsants is to be attributed to their breakdown into acid end-products such as benzoic acid, thereby compensating for a physiologic deficiency in the acid medium within or about nerve cells. Apart from the extracerebral factor, it appears probable that an underlying epileptic predisposition or diathesis is necessary for the development of the disease. In this connection, it is noteworthy that Lennox, Gibbs and Gibbs (*6*) adduced electroencephalographic evidence in support of the part played by heredity in convulsive states. Their studies revealed the incidence of asymptomatic cerebral dysrhythmia in the general population to be about 10 percent. A statistical consideration of epilepsy associated with traumatic (*2*) or neoplastic (*3*) insult to the brain, however, in revealing an incidence higher than that of the presumed hereditary predisposition in the general population, strongly suggests that the acquired factor in these cases is of greater significance than in the cryptogenic variety.

EXAMINATION AND ASSESSMENT.

In the clinical approach to every case of epilepsy an effort is made to determine whether a specific epileptogenic focus exists. Frequently, this may be determined from the neurologic history alone, as for example, the elicitation of a story of paroxysmal head and eye turning to one side suggesting a lesion in the contralateral frontal adversive field. The pattern of the attack may reflect any of the various functions resident in the cerebrum, namely, psychic, motor, somatosensory, visual, autonomic, etc. For each of these a corresponding anatomic substrate can be invoked. Unequivocal evidence of a specific focus resulting from injury is not usually to be expected from the neurologic examination, although occasionally post-traumatic lesions give rise to such signs as motor impairment and reflex alteration.

Laboratory studies, including blood, urine, and skull radiographic examination should be undertaken routinely, though except in the latter case, they are not apt to be of real significance where epilepsy is closely related to trauma.

Corroborative evidence of the clinical impression pointing to the existence of a specific epileptogenic focus may be obtained from electro- and pneumoencephalographic studies. Where possible, pneumoencephalography should be preceded by electroencephalographic study. The latter is apt to disclose a disturbed rhythm, generally paroxysmal high voltage waves, of high, low, or even normal frequency.

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The pneumoencephalographic picture in post-traumatic epilepsy generally points to an atrophic cerebral lesion, unless a hematoma is present, in which case one may expect a compression of the ipsilateral ventricle with obliteration of the subarachnoid sulci on that side and a shift of the entire ventricular system in the direction of the contralateral hemisphere. With the more usual atrophic lesion, the opposite combination tends to exist, namely, dilatation of the ipsilateral ventricle and subarachnoid sulci, and a tendency for the ventricular system to "wander" toward the side of the lesion.

NONSURGICAL TREATMENT.

Basic medical therapy in epilepsy is concerned with the amelioration or arrest of seizures by anticonvulsant medication. Measures such as the ketogenic diet and dehydration may be used as adjuvants but have generally not been found to be of sufficient efficacy by themselves.

Though it is felt by some that when a specific atrophic epileptogenic surgical lesion exists it should be dealt with operatively, the fact that medicinal therapy alone will control seizures of such origin in many instances has prompted the routine utilization of a preliminary period of medication. If after an adequate regime of medicinal therapy seizures continue to be of a disturbing intensity and frequency, surgical measures are in order.

As previously mentioned, it is thought that the various synthetic anticonvulsants stabilize the cortical rhythm by cellular breakdown to acid end-products, such as benzoic acid (*5*), thus compensating for a physiologic deficiency in the acid medium within or about nerve cells. An exception to this rule occurs in the case of the bromides, which are not broken down in the body and cannot be regarded as acting in a manner similar to other anticonvulsants.

The commonly used anticonvulsant drugs are dilantin, phenobarbital and bromides. The use of any one of these in optimal amounts will effect a favorable result in at least 60 percent of cases. The bromides do not appear to be as efficacious as the other two, and should be used chiefly when an adequate trial with phenobarbital or dilantin has been ineffective or productive of toxic manifestations. Dilantin has been found to be of greater usefulness than phenobarbital because of its superior anticonvulsant and lesser hypnotic qualities. It is important that treatment be individualized in each instance to ascertain the optimal drug or combination of drugs to be used in any given case.

SURGICAL TREATMENT.

Efforts at surgical relief are indicated if, after an adequate trial with anticonvulsant medication, seizures continue with disturbing

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intensity and frequency. Experience has shown that good results with surgery are only to be expected if a gross lesion is present. This applies alike to cases of cryptogenic epilepsy having no single focus and to those having an evident focal point but with a normal-appearing cortex (*3*).

The treatment of gross focal lesions has largely been concerned with their excision. Results have been variable. On the basis of accumulating reports, it may be stated that about 20 percent of cases can be referred to as cured, and that varying degrees of improvement may be expected in another 40 percent. An adequate explanation for the unimproved is not at hand, but it is evident that excision must necessarily have limitations governed by the location and extent of the lesion. When the latter occupies an area subserving the function of speech or motor power, an adequate excision that does not jeopardize the patient's integrity is not to be expected. Furthermore, with large excisions some scar reformation may be anticipated.

These considerations suggested the utilization of an additional approach to the problem to be employed in cases where cicatricectomy might not offer much promise. This was posited on the assumption that the epileptic seizure is in some way associated with a capricious underlying cerebral vascular mechanism. Allusion has been made to the progressive destruction of gray matter associated with periodic closure of minute blood vessels in atrophic epileptogenic lesions. Among the earliest attempts to ameliorate epilepsy through influencing the cerebral circulation were those of Alexander (*7*), who tried to accomplish this result by cervical sympathectomy. The failure of this procedure and its subsequent abandonment is paralleled by more recent experimental evidence indicating that the cervical sympathetic plays but a small role in cerebral vasoconstriction (*8*). The development of collateral cerebral circulation in lower animals has been successfully carried out by German and Taffel (*9*). Their investigations suggested to the author the possibility of augmenting the circulation of the atrophic epileptic brain by encephalomyopexy, utilizing the temporal muscle for this purpose.

Reports of the first five cases in which the operation was carried out, and the underlying rationale and technic, are presented elsewhere (*10*) and need not be detailed here. The inclusion of two additional cases and the longer follow-up now available permit sounder conclusions as to the efficacy of the procedure. In regard to technical considerations, suffice it to state that the bone defect in the infratemporal region is made just large enough to admit the pedicle of the temporal muscle without constricting it. The window of bone removed to permit the placing of the muscle is wired to the surrounding skull. No untoward effects have been noted as a result of the procedure.

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Though operation is carried out in the rolandic zone, motor and speech function remain unaffected. The limitations in muscle-grafting onto the cortex are governed by the extent of available temporal muscle. Fortunately, most of the post-traumatic lesions capable of causing focal epilepsy are in and near the rolandic zone within range of this particular structure. The procedure naturally would not be adaptable for the treatment of lesions toward the frontal and occipital poles or near the midline.

The first of these procedures was undertaken on 13 October 1941, on a patient presenting criteria which seemed sufficient to justify operation: A post-traumatic hemispheric atrophy with contralateral hemiparesis and severe epilepsy involving the palsied limbs. In the intervening period six additional patients have had myopexies performed. All seven patients have now been followed for periods ranging from 6 to 18 months. The postoperative medication in all instances was maintained as close as possible to that which failed to control seizures preoperatively. In two patients paroxyms reappeared soon following operation, although with considerable diminution in frequency and intensity, and this has been maintained. These differed from the benefited cases in presenting considerably less evidence of a discrete focal lesion. Of the five benefited cases, three (followed 7, 11, and 12 months) have had no recurrence of seizures. The other two (followed 6 and 13 months) have had two and three postoperative seizures respectively. Considering the fact that all of these individuals had preoperative convulsion frequencies varying from a few daily to one every 2 weeks, despite medication, they are for the present regarded as improved. In general, the benefited cases shared the common denominator of a macroscopic cerebral lesion, such as cystic degeneration, corresponding to the individual's focal manifestations. Three of the patients who prior to operation were paretic on the side corresponding to their seizures believed themselves to be much stronger in the impaired limbs postoperatively. This was not borne out by objective study. Since these were hemipareses of long standing, the failure to secure more substantial improvement in motor power is not surprising.

SUMMARY AND CONCLUSIONS

1. Epilepsy following penetrating brain wounds is common.
2. All such cases should receive appropriate studies to determine the existence of a specific focal atrophic lesion.
3. An adequate trial with anticonvulsant medication is indicated, even in the presence of a specific focal atrophic lesion.
4. Surgical measures should be considered if a focal lesion is present and seizures continue with disturbing frequency and intensity despite medication.

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5. Cicatricectomy is the procedure of choice unless the lesion involves an area subserving vital function or is too extensive to permit removal without the expectation of some scar reformation.

6. Encephalomyopexy has been undertaken for atrophic epileptogenic lesions of the rolandic zone not amenable to cicatricectomy.

7. The rationale and results of this latter procedure are discussed.

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PROLONGED TRYPARSAMIDE THERAPY

The results of the liver function tests on 66 patients reveal that tryparsamide causes relatively little liver damage even when given over a prolonged period of time and combined with fever therapy.

Jaundice occurring during therapy consisting of trivalent or pentavalent arsenicals or fever or the combination disappears without important damage to the liver and is in itself no contraindication to the further use of tryparsamide.

Malarial fever produces evidence of liver damage which is transient. The use of tryparsamide immediately following fever does not increase the amount of liver damage or delay repair.—Kopp, I., and Solomon, H. C.: The effect of prolonged tryparsamide therapy upon liver function. Am. J. Syph., Gonor. & Ven. Dis. 27: 445–459, July 1943.

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ILLITERACY

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Illiteracy is not an uncommon condition and yet receives comparatively little attention in normal times. During periods of war and national emergency, however, it becomes important, since large numbers of men must be recruited for the various services and existing psychologic disabilities must be evaluated in terms of their probable influence on the recruit's subsequent adjustment to military life.

Popularly, illiteracy is considered merely the inability to read and write. Technically, however, illiteracy should be regarded as the inability to read, write, and *comprehend*. The matter of comprehension is significant since it is possible for individuals to learn to read in a mechanical fashion with little or no understanding of what has been read. As Stroud (*1*) has indicated, it is pointless, except for experimental purposes, to consider as reading the mere perception of isolated words without comprehension.

While no precise academic or literacy standards have been set for enlistment in the Navy, general provisions are to be found in paragraph 1404 (a) of the Manual of the Medical Department of the United States Navy (*2*):

> No educational standard has been officially established for recruits presenting themselves for enlistment in the naval service. The regulations require, however, that a candidate shall be able to read and write and that he should possess a reasonably quick and clear understanding.

Notwithstanding this regulation, illiterates are not infrequently discovered at naval training stations during psychiatric and psychologic examinations, and thus become problems insofar as disposition is concerned. The purpose of the present paper is to discuss the problem of illiteracy in the light of experience gained at the Great Lakes Naval Training Station.

There is no universal criterion as to what constitutes illiteracy, and therefore arbitrary standards are found to exist. Consequently, varying technics of measurement prevail. At this station it has been found convenient and practical to use a selection based on passages from the Bluejackets' Manual (*3*), a procedure described in an earlier issue of this BULLETIN (*4*). Since this manual represents the type of material the typical naval recruit may be expected to read during his naval career, it is reasonable to assume that for naval purposes a test based on this manual is a valid tool in determining the existence or nonexistence of illiteracy.

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To determine some of the psychological aspects of illiteracy as encountered in the Navy, an analysis was made of the records of 100 recruits discharged by special order primarily on the basis of this defect. These recruits represented 27 states with no particular geographical area predominating. The chronological age range was from 17 to 46 years, with an average of 20.2 years. The highest grade in school completed by any recruit was the 8th, and the average school grade attained was 5.3. The average age at leaving school was 14.5 years.

TABLE 1.—*Reasons for leaving school*

Reason	Percent	Reason	Percent
Employment	38	Disliked school	6
Support family	34	Miscellaneous	15
Difficulty in learning	7		

The fact that the average age at leaving school was 14.5 years while the average school grade completed was 5.3 indicates scholastic retardation by the majority of illiterates used in this study. The various reasons for leaving school are presented in table 1. It will be noted that economic reasons (employment; support of family) accounted for 72 percent of the reasons given. These reasons were those volunteered by the recruit and were thus subject to falsification.

TABLE 2.—*Occupational analysis*

Occupation	Percent	Occupation	Percent
Labor (semiskilled and unskilled)	46	Labor (skilled)	2
Farming	42	Miscellaneous	10

The former civilian occupations represented by these illiterates merit consideration. In table 2 is found an occupational analysis based on the vocation principally pursued by the recruit prior to his enlistment. It is seen that almost half (46 percent) were semiskilled and unskilled laborers, and that a closely approximating number (42 percent) were farmers. These findings coincide with those obtained by Koenig and Smith (*5*) among selective service registrants.

It is reasonable to expect that illiteracy and mental retardation occur coincidentally. Rosanoff (*6*) has pointed out that "* * * the clinical histories of the illiterate patients show that most of them have been unable to learn to read and write owing to inherent mental defectiveness." The data in the present paper point to the relationship between illiteracy and mental retardation but not necessarily between illiteracy and mental defectiveness in a technical sense.[2] In table 3

[2] The term mental retardation is generally used to denote any degree of intellectual development which falls below normalcy (below 90 in terms of I. Q. points) while mental deficiency indicates actual feeblemindedness, embracing idiot, imbecile, and moron levels.

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is found the distribution of intelligence as determined through psychometric examination. The Kent Oral Emergency Test (*7*) and the Bellevue-Wechsler Adult Intelligence Scale (*8*), examinations which have been found suitable in the examination of naval personnel (*9*) (*10*) (*11*) (*12*), were used in making this determination. The mean I. Q. obtained was 77.30, with a standard deviation of 5.97. It will be observed that over three-fourths (77 percent) of the subjects tested at the borderline level of intelligence (66–79 I. Q.), while only 2 percent were of normal intellectual development. Mentally deficient subjects were not employed in this study since they were discharged on the basis of that disability. While the mentally deficient subjects possess varying degrees of illiteracy, it is by no means true that mental deficiency in itself implies illiteracy, since many mentally deficient patients are able to read and write surprisingly well.

TABLE 3.—*Distribution according to intellectual level*

Classification	I. Q.	Percent
Normal	91–110	2.0
Dull normal	80–90	21.0
Borderline	66–79	77.0

It is significant to note that those illiterates of normal and dull normal intelligence, who, for all practical purposes, have the necessary intellectual endowment to be able to learn to read and write, frequently reveal psychiatric disabilities of a constitutional type, and histories of scholastic, occupational, and social maladjustment. Such individuals are found to be lacking in the ability to read and write principally because they lack the drive and initiative to acquire these particular skills. In this regard, it is necessary to rule out the existence of specific reading disabilities—disabilities revealed among intelligent and well-motivated individuals which can be, and usually are, overcome through persistent and diligent training in remedial reading. The above discussion does not preclude the fact that there are persons of adequate intelligence and without psychiatric disability who are illiterate because of cultural and environmental limitations.

Whether or not the Navy as a military organization can use illiterates to advantage is a question over which there is some disagreement. There are those who contend that illiterates can be of service provided they are detailed only to specific routine tasks. Others hold that they are a poor risk under any circumstances and are prone to become naval liabilities. If illiterates were accepted by the Navy for only circumscribed detail, it would be necessary to designate each illiterate in some way so that his defect would be recognized when

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transferred from duty to duty. Obviously, such a procedure would involve much routine. Ultimately, the question of the illiterate's responsibility in the matter of following and abiding by written orders is bound to present itself. Should failure by an illiterate to carry out written orders arise as a disciplinary problem, the subsequent complications that will come about as to personal responsibility must be obvious.

It has also been suggested that the Navy provide literacy classes for the instruction of recruits enlisted as illiterate. While this may be an ideal peacetime arrangement, there are complicating factors in times of national emergency. The teaching of reading is not an easy task and it becomes more difficult when dealing with the mentally retarded. Then too, such teaching cannot be left in the hands of the untrained. Satisfactory instruction of the illiterate can be expected only from those who have had training and some clinical experience in the field of remedial reading. If such schools were established, enrollment should be limited to those of adequate intellectual development who are without psychiatric handicaps.

SUMMARY

The purpose of this paper was to discuss the problem of illiteracy as a specific psychologic disability. In this regard, the clinical records of 100 naval recruits discharged by special order primarily on the basis of this disability were reviewed.

1. The average age of these illiterates was 20.2 years, and the average school grade completed was 5.3.
2. The average age at leaving school was 14.5 years, indicating marked scholastic retardation when compared with the average school grade completed.
3. In terms of civilian occupation, semiskilled and unskilled labor was represented by 46 percent of the subjects, and farming by 42 percent.
4. Economic reasons (employment; support of family) were the most frequent reasons given for leaving school.
5. Mental retardation was found to exist in practically all of the cases. The mean I. Q. was 77.30, with a standard deviation of 5.97.
6. Illiterates of adequate intellectual ability were frequently found to be lacking in motivation and presented histories of scholastic, occupational, and social maladjustment.
7. Illiteracy in itself is no criterion of feeblemindedness.
8. A discussion of the use of illiterates in the naval service has been presented.

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SULFADIAZINE IN TREATMENT OF MALARIA

Sulfadiazine is an effective antimalarial.

It is exhibited with a minimum of toxic reaction and is therefore taken by patients with less reluctance than is quinine.

The relapse rate, employing our dosage schedules and in therapeutic quartan malaria, has been established at 23 percent. The amount of treatment used appeared to have no relation to the relapse rate. Patients suffering relapses had had 5, 8, and 9 days of treatment respectively.

Relapses are controlled by a second course of sulfadiazine. No patient has had a second relapse.

The antimalarial action of sulfadiazine could be used to advantage by the military in malarious areas.—Johnson, C. E., Jr.: Status of sulfonamide therapy in malaria. Am. J. M. Sc. 206: 327–336, September 1943.

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EFFECT OF CHANGES IN BAROMETRIC PRESSURE UPON DENTAL FILLINGS[1]

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A review of the literature discloses little information on the effects of changes in barometric pressure on dental fillings. References have been made to aviators experiencing the displacing of fillings at high altitudes. This information is not substantiated by any accurate, published data. In 1937 Armstrong and Huber (*1*), in discussing the effects of high altitude flying on human teeth and dental restorations, concluded that "environmental conditions encountered at altitudes between 10,000 and 40,000 feet, in addition to the inhalation of oxygen cooled to a maximum of −60° F., have no deleterious effect on human teeth or dental restorations."

In a recent abstract in the British Dental Journal, Dreyfuss (*2*) cites instances where flying personnel experienced dental pain while at higher altitudes. In one case the pain was traced to a subacute pulpitis in a lower third molar, and did not occur after the tooth was devitalized. In the same review, it was stated by Meir that cold air might promote paradental disturbances in high flying personnel. Recently Harvey (*3*) reported that "iced drinks and ice cream can certainly produce lower tooth temperatures than high altitude flying." Harvey also adds that the temperature range used in the experiments of Armstrong and Huber is not likely to occur using modern oxygen equipment for high altitude flying. He further states that the range is probably about 20° to 45° C. which is well within the limits which may occur in everyday life. Therefore, the contraction and expansion of metal fillings will be no more likely to occur in the high altitude airman than in ground personnel. Harvey's results do not support Koelsch's (*4*) suggestion that due to cold, metal fillings will contract and drop out at high altitudes.

This study is an attempt to determine the effects of low barometric pressure on dental restorations constructed of properly and improperly manipulated filling materials.

One hundred and fifteen amalgam, cement-silicate, and oxyphosphate of zinc cement fillings were placed in freshly extracted human teeth. All cavities filled were of uniform depth and diameter; however, the filling materials were manipulated so as to control the prop-

[1] From the Dental Research Department, Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md.

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erties and qualities of the completed fillings. The number and type of each restoration is shown in table 1.

TABLE 1.

(A) *Filling materials manipulated and inserted according to the manufacturer's specifications*

Filling material	Number of fillings	Simulated altitudes 10,000–30,000 ft. Findings following 20 intervals of 1 hour each	Simulated altitudes 60,000 ft. Findings following 20 intervals of 1 hour each	Findings upon removal of fillings at end of 40 hours
Amalgam	15	No gross change	No gross change	No perceptible presence of moisture or stain under fillings.
Cement-silicate	15	do	do	
Zinc oxyphosphate	15	do	do	

(B) *Filling materials improperly manipulated and inserted*

Amalgam:				
Dry	10	No gross change	No gross change	Slight penetration of stain; no perceptible moisture.
Wet	10			
Air space	10	do	do	Moderate amounts of stained solution.
Cement-silicate: Dry	10	do	do	Moderate presence of stain.
Air space	10	do	do	Air spaces completely filled with stained solution.
Zinc oxyphosphate:				
Dry	10	do	do	Moderate presence of stain.
Air space	10	do	do	Air spaces completely filled with stained solution.

Under 30 restorations an air space was present between the filling and the base of the cavity. This provision was made in order to determine if trapped air was capable of displacing a filling exposed to pressure changes.

Twenty cement-silicate and oxyphosphate of zinc cement fillings were made with an excessive amount of cement powder, producing a dry mix. The remaining 10 amalgam fillings contained excessive or reduced amounts of mercury.

Before the filled teeth were exposed to pressure changes, the apical third of the roots were coated with sticky wax and the entire root portion of each tooth was imbedded in artificial stone.

The filled teeth were then placed in a pressure chamber and exposed to barometric changes. Simulated altitudes of 10,000 to 30,000 feet were first tried; no displacement of any filling occurred at this barometric level. Finally the filled teeth were exposed to an extreme decrease in barometric pressure simulating an altitude of 60,000 feet. This pressure was maintained intermittently for 20 periods of 1 hour each; still there was no displacement of any filling.

Finally, all the filled teeth were immersed in a 5 percent alcohol basic fuchsin solution, and then subjected to similar pressure changes.

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Suitable controls at normal atmosphere were maintained throughout this phase of the experiment. This was done to see if the barometric pressure, when increased, would cause forcing of the stained solution under the fillings.

Upon the removal of the fillings there was no perceptible stain under any filling where the materials were manipulated and inserted according to specifications; whereas, under those made with the wet or dry mix, penetration of stain was found in all cases. The controls kept at normal atmospheric pressure disclosed less degree of penetration under the fillings.

Upon removal of the fillings which had air spaces, marked amounts of solution were found in the cavities, regardless of the type of filling; while in the controls no collection of fluid was observed. It would seem possible that during rapid ascents and descents, oral fluids could be forced under leaking fillings or ones with air spaces—*which may account for some of the toothaches experienced by flying personnel.*

CONCLUSIONS

Displacement of properly inserted dental fillings exposed to extremely low barometric pressures seems improbable. It is believed that restorations, even though constructed with improperly manipulated filling materials or with air spaces present will not be displaced. Enough marginal leakage would occur to preclude the displacement of amalgam, cement-silicate, and oxyphosphate of zinc cement fillings, even though these restorations are exposed to extremely rapid changes in barometric pressure.

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RATE OF OCCURRENCE OF EPITHELIAL TISSUE IN PERIAPICAL LESIONS

REPORT OF 103 CASES [1]

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Since the frequency of occurrence of any pathologic condition as determined by microscopic examination may be an index of expectancy of future disturbances and may determine the surgical procedure, it seems appropriate that more of such studies should be made. Much of the dental histopathologic material which is presented from time to time apparently is of a selective nature. This is probably due to the time and effort necessary to accumulate and prepare dental tissue specimens for study. The selected microscopic picture is so thoroughly described that the reader is led to believe that the phenomenon is one usually to be expected, when, as a matter of fact, it may only be an elaborate presentation of a few tissue specimens. Studies on epithelial content of dental periapical lesions, however, have been more thorough. The controversy as to removing or allowing such lesions to remain in the alveolus after extraction has been responsible for this advance.

McConnell (*1*) studying over 100 specimens from periapical lesions found about 30 percent containing epithelium in greater or lesser amounts. In a series of 131 such lesions, Hill (*2*) cut 89 routinely and 42 serially. Those cut routinely showed similar findings to those of McConnell (quoting McConnell incorrectly), 33 to 35 percent. All those cut serially contained epithelial tissue. Freeman (*3*), in over 200 periapical specimens, found 45 percent containing no epithelial tissue. McCrea (*4*) studied 60 such lesions cut serially and found that 35 or 59 percent showed no epithelial tissue in the area of inflammation although the dental periosteum showed epithelial rests. The epithelium in 25 or 41 percent, was found to have proliferated.

The purpose of this investigation is to contribute further information to the rate of occurrence of epithelial tissue in periapical lesions.

PROCEDURE

Tissue specimens were procured and treated in the following manner: Teeth showing periapically-involved areas roentgenologically and destined for extraction were chosen for this work. Upon extraction the periapical tissues were removed from the alveolus with a

[1] From the Dental Research Department of the Naval Medical Research Institute and the Naval Dental School, National Naval Medical Center, Bethesda, Md.

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curette and immediately placed in a 10 percent formalin solution. When the lesion came away with the tooth, the entire specimen was immediately placed in the fixing fluid. Fixing continued 48 to 72 hours. Soft tissues were treated according to a routine paraffin embedding technic. Harris' hematoxylin eosin without the acetic acid was used for staining the sections. Serial sections were not cut; however centrally located cuts were made through the lesions. Evaluations were made based upon the presence or absence of epithelial tissue in each specimen procured.

RESULTS

Of 103 periapical lesions which were sectioned and examined 43 (41.7 percent) contained epithelial tissue in different stages of differentiation. Sixty (58.2 percent) showed no epithelial tissue. Strangely enough, this frequency of occurrence is almost identical with the findings of McCrea (*4*) and approximates those of Freeman. McConnell's results are lower and those of Hill are extremely high compared to McCrea and to our studies.

CONCLUSIONS

Since it is generally conceded that epithelial tissue inclusions, when stimulated by any agent (among which may be inflammatory processes) might proliferate to produce cysts of different types (*5*), and since the frequency of occurrence of epithelial inclusions is as high as has been shown, removal of all periapical lesions instead of permitting periapical lesions to remain after tooth removal, is strongly emphasized. Hoping for their ultimate absorption is not a sound procedure.

The writer wishes to express his sincere thanks to Commander R. W. Taylor (DC), USN, Lieutenant S. R. Howell (DC), USN, and Lieutenant, junior grade, C. W. Miller (DC), USN, for sending in the tissue specimens, and Chief Pharmacist's Mate Walter H. Ordway, USN, for sectioning, staining and mounting the tissue specimens.

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DANGERS OF BORIC ACID

Intoxication with boric acid and other borate compounds is a constant threat which physicians and laymen rarely appreciate. Boric acid is an insidious, carelessly used, poisonous drug with power of fatal poisoning.

Boric acid compounds are widely used with impunity by both medical and lay groups for a great number of purposes. The eyes of almost every newborn infant are cleansed with boric acid in hospitals and homes. It is a common practice to use boric acid as an antiseptic for rubber nipples and to cleanse the nipples of nursing mothers. Even in the literature accompanying a popular brand of rubber nipples, boric acid is recommended for purposes of sterilization. Yet a case of boric acid poisoning in a 2-day old infant due to nursing its mother's breast after boric acid had been used as a nipple wash is reported. Boric acid and borate compounds are usually dispensed without a poison label and may be found upon the medicine shelf of any home.

There have been interesting experiences with the local absorption of boric acid from wounds and body cavities. It has been reported that boric acid, when applied to the unbroken, living, human skin, was the only substance of many tried which appeared in the urine in appreciable quantities. It was found in the urine 5 minutes after the feet were immersed in boric acid solution.—Ross, C. A., and Conway, J. F.: The dangers of boric acid; its use as an irrigant and the report of a case. Am. J. Surg. 60: 386, June 1943.

SULFONAMIDES IN BURN THERAPY

The local use of the sulfonamides has not improved the results in the treatment of open wounds when used as an adjunct to good surgery during the contaminated stage; however, it was found not to delay the healing time.

All of the sulfonamides produced some local tissue irritation as evidenced by the increase in serum and tendon adhesions.

The results of this study indicate the local use of the sulfonamides is not necessary in the early treatment of open wounds which can be thoroughly cleansed and debrided. These drugs may produce enough irritation to contraindicate their use in such cases.

The use of the sulfonamides may be of definite value when administered in badly disruptured wounds which cannot be thoroughly cleansed and debrided. When combined with the use of one of the drugs by mouth, sulfonamides are invaluable in this type of case.

The criteria of good early treatment of any open wound is thorough cleansing and the removal of all contaminated and nonviable material followed by wound support and rest. Under no circumstances should the sulfonamides be substituted for this treatment.—Overton, L. M.: The local use of the sulfonamides in open wounds. J. Iowa M. Soc. 33: 409–412, September 1943.

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CLINICAL NOTES

HEREDITARY HEMORRHAGIC THROMBASTHENIA WITH SEVERE POST-HEMORRHOIDECTOMY HEMORRHAGE

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and
EUGENE L. LOZNER
Lieutenant (MC) U. S. N. R.

The practice of elective surgery in the naval service usually involves patients who are rugged and free from hemorrhagic diatheses. Ordinary surgical procedures may therefore frequently be performed without a sufficiently inclusive history or preoperative examination. The following case illustrates an avoidable and potentially fatal possibility.

CASE REPORT

A navy electrician was admitted to the hospital with a diagnosis of hemorrhoids. His family history was not given; his past history included only the fact that he had had an appendectomy 8 years ago, with no complications. The present illness began 5 or 6 years ago with prolapsing internal hemorrhoids. Bowel movements were occasionally painful and recently there had been considerable rectal bleeding.

Physical examination showed the patient to be a well nourished, healthy male with the exception of the prolapsing hemorrhoids. On sigmoidoscopic examination up to 25 cm., a normal mucosa was found. The result of a blood Kahn test was negative. The concentration of hemoglobin was 15.0 gm. per 100 cc. of blood. Erythrocytes numbered 5,010,000 and leukocytes 5,050; the differential count revealed no abnormalities.

Two days later hemorroidectomy was performed by the clamp and ligature method. All immediate hemorrhage was controlled by transfixion ligatures. Procaine hydrochloride was the spinal anesthetic used.

The postoperative course was smooth for 6 days, with the exception of a slight oozing of blood from the anus. On the 7th day the patient began to bleed severely after having a bowel movement. Large old and fresh blood clots were passed. The anal area was explored and resutured. A transfusion of 500 cc. of citrated blood was administered and bleeding was largely controlled but not stopped. Seven days later another severe hemorrhage occurred. The anus was again explored and a frankly bleeding vessel was found and resutured; however, the entire anal area was oozing blood. Repeated transfusions were given, and the bleeding diminished to a slight oozing.

After an interval of 10 days the patient again passed old and fresh blood clots. The anus was explored and the entire operative area was found to be oozing blood. No definite bleeding vessels were seen. The area was again

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resutured but bleeding continued. Daily small transfusions of blood were administered and the anus was packed tightly with gauze. This regime was continued for 10 days during which the bleeding progressively diminished. On the thirty-fourth postoperative day the packing was removed and insignificant bleeding continued for 2 days and then ceased completely.

Examination showed the entire area to have good epithelization. There was no stricture, and bowel movements had returned to normal. The patient was instructed to take 1.2 gm. of ferrous sulfate daily and was given 1 month's sick leave. At the end of that time physical examination and laboratory studies of the blood revealed no abnormalities.

Supplementary laboratory findings, clinical and family history.—When it became apparent that the bleeding in this patient was not due to local unligated vessels, complete blood studies were made. All yielded normal findings except for slightly prolonged bleeding time. A more careful history disclosed that following a tonsillectomy and adenoidectomy, the patient had experienced hemorrhage of 2 weeks' duration. Following a tooth extraction in early years he had a hemorrhage which lasted 3 weeks. There had been no tendency to bleed unduly from a cleanly incised laceration or from puncture wounds, but abrasions always had bled freely for long periods and necessitated pressure dressings.

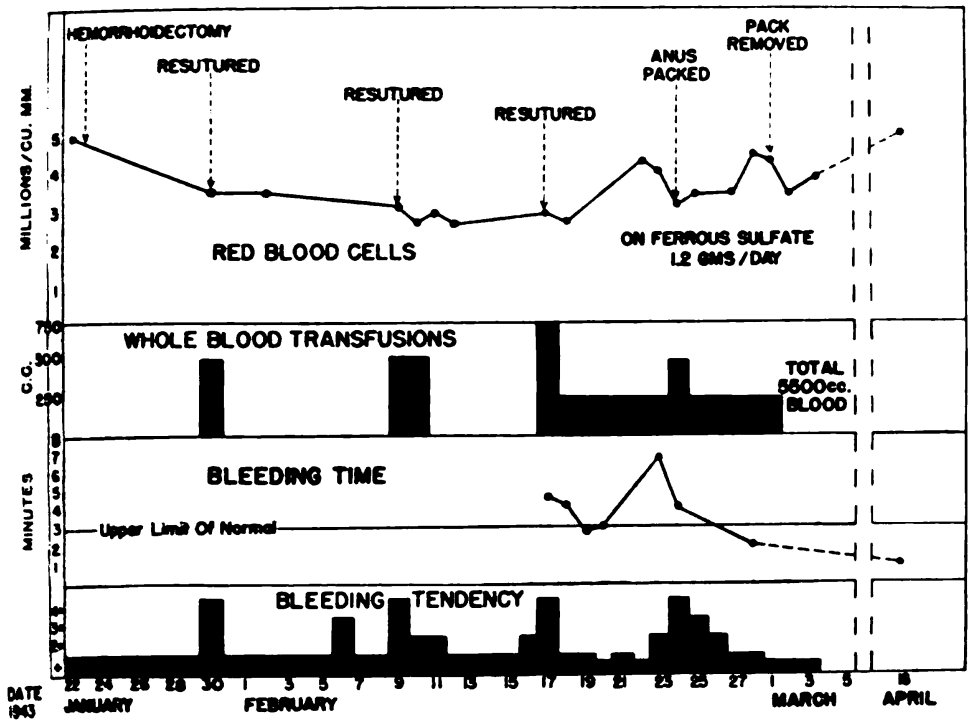
The family history was striking. Almost all the male members on the maternal side of the family have a tendency to bleed from abrasions, tooth extractions and tonsillectomies. The patient's mother stated that no female members of the family were affected. It was not possible to work out the hereditary aspects other than to say that the patient's brother, maternal male cousins and maternal grandfather were similarly affected.

The accompanying table and chart show the patient's hospital course and the laboratory findings.

TABLE 1.—*Résumé of laboratory findings pertaining to hemorrhagic diatheses*

Date	Bleeding time (minutes)	Clotting time (minutes)	Platelet count (thousands per cu. mm.)	Prothrombin time (seconds)	Tourniquet test	Clot retraction
Normal values	½–3	2–4	200–400	15–20	Normal	Good.
1–30–43		4				
2–12–43			208			
2–17–43	4½	2½	178	18	Normal	Good.
2–24–43	7½	2	254	14	do	Do.
3–10–43		4		16		
3–12–43		2¾	356	20	Normal	Good.

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1. Chronological hospital course of the patient.

DISCUSSION

The diagnosis of the condition described here is established entirely by exclusion as that of hereditary hemorrhagic thrombasthenia (*1*), also known as constitutional thrombopathy (*2*), hereditary pseudohemophilia (*3*), hereditary hemophilioid purpura (*4*), athrombocytopenic purpura (*5*), and familial purpura hemorrhagica without thrombopenia (*6*). This disease is defined by Quick (*7*) as a "hereditary hemorrhagic disease transmitted by and appearing in both males and females, characterized by a prolonged bleeding time and by no demonstrable abnormality of the blood nor of the coagulation mechanism." It has been classified by Lozner (*8*) as a "nonthrombocytopenic hemorrhagic diathesis resulting from functional disease of the peripheral vascular system." Macfarlane (*5*) has recently demonstrated a failure of the capillaries to contract after injury in this disease.

Both the hereditary aspects and the clinical picture presented by the patient reported here fit in well with the diagnosis of thrombasthenia. The familial tendency to bleed excessively from abrasions and following minor operations, and the lack of purpura are classical (*9*). The inconstancy of the prolonged bleeding time and the limitation of the family tendency to the male line are perhaps atypical. However, Quick (*7*) points out that "in mild cases the bleeding time may often return to normal." Inasmuch as true hemophilia is the

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only known sex-linked hemorrhagic diathesis, and this patient showed normal blood coagulability on repeated examination, thrombasthenia remains the most likely diagnosis.

Specific inquiry as to the presence of an abnormal bleeding tendency in the family or past history of this patient might have prevented the severe postoperative hemorrhage reported here. Naval personnel even more than civilians do not offer information other than that asked for by the medical officer. Accordingly it is of even greater importance in the naval service for the medical officer to make direct inquiry prior to elective surgery, regarding the existence of a hemorrhagic tendency.

SUMMARY AND CONCLUSIONS

1. A case of hereditary hemorrhagic thrombasthenia in the naval service is reported.

2. The diagnosis was not made preoperatively because of an inadequate family and past history of the case. Consequently 5,500 cc. of fresh citrated blood had to be administered to the patient.

3. It is urged that an adequate family and personal history regarding bleeding tendency be obtained from all patients who are candidates for elective surgery.

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MENINGOCOCCEMIA WITH WATERHOUSE-FRIDERICHSEN SYNDROME

EARLY RECOGNITION BY MEANS OF BUFFY LAYER SMEARS

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More than 30 years have elapsed since the Waterhouse-Friderichsen syndrome was first described. In the last year, however, doubt has assailed its position as a clinical entity (*1*). Fewer than 80 cases have been reported and most of these were in children. In fact Kwedar (*2*) stated that 70 percent of the children's cases have occurred in infants less than 2 years of age.

The original report of the syndrome described a purpuric rash associated with an overwhelming and fulminating meningococcemia with the postmortem finding of a massive adrenal hemorrhage. The destruction of adrenal tissue has been suspected of reducing the pressor hormonal secretions and producing a hypotension, which in these cases progresses into a profound and irremediable shock due to rapid circulatory failure.

While this syndrome is rare in adults it has been observed in infants following difficult or breech deliveries. Hemorrhage into the adrenal parenchyma has been noted, however, in anaphylactic reactions and in diphtheria.

Some authors have reserved the term Waterhouse-Friderichsen syndrome only for those instances where the symptoms and findings occur concomitantly with a meningococcemia.

While it is recognized that a meningococcal septicemia precedes definite meningeal involvement in a high percentage of cases, the following case is interesting for the reason that the accompanying meningitis is observed in a phase incipient to any marked elevation in the spinal fluid cell count. Of further interest is the rapidity with which diagnosis was made. By gram-staining a bacterial concentration in the buffy layer, identification of the Neisseria intracellularis was readily accomplished.

CASE REPORT

A private in the Marine Corps, 18 years of age, was first seen at the dispensary in the early evening of 24 March 1943; he complained of a slight throat irritation and a headache. He was found to have a fever of 100° F. A diagnosis of catarrhal fever was made, and he was placed on the binnacle list for overnight observation, hot saline gargles and phenacetin compound capsules being prescribed. The next morning he still complained of a headache, but a petechial rash and cyanosis were noted and he was transferred to the hospital.

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On admission his sensorium was clouded. His entire skin surface was covered with a petechial rash which varied from pin points to purpuric ecchymoses 25 mm. in diameter on a deeply cyanotic background. The fever had risen to 105° F. and the pulse, which was weak on arrival, rapidly became imperceptible; respirations grew increasingly rapid and shallow. His blood pressure, 100/70 on entry, in a short time became unobtainable. Repeated skin punctures for hematological work failed to draw blood and it was necessary to resort to venipuncture. Kernig's sign was only faintly suggestive and there was no rigidity of the neck. Heart sounds were distant, the lungs were resonant and without râles.

Spinal puncture revealed a clear fluid with a cell count of 8 per cu. mm. The erythrocyte count was 5,600,000 with 15.4 gm. of hemoglobin; the leukocyte count was 9,700 with 74 percent segmented cells, 2 percent band forms, 21 percent lymphocytes, and 3 percent monocytes. In a Wright's stained blood film an intracellular diplococcus was observed, which prompted the adoption of the following technic in order to insure concentration of the organisms present.

Blood drawn again from the vein and oxalated had a cherry red color as if partially "laked." Four cubic centimeters of this oxalated blood was centrifuged in a narrow tube at high speed for approximately 20 minutes; the plasma was then carefully withdrawn using a capillary pipette down to the buffy layer; this layer was then removed from the packed red cells with a loop or fine pipette and smeared on two slides. The smear was fixed in methyl alcohol and gram-stained. Other slides were stained with Wright's stain. Microscopic examination of these smears showed fields that were packed with leukocytes and numerous gram-negative diplococci both intra- and extra-cellular. The organisms morphologically resembled Neisseria intracellularis.

Intravenous plasma and sulfadiazine, as well as various stimulants and an oxygen tent, were employed without effect. The cyanosis deepened and the patient expired 2 hours and 10 minutes following admission.

Necropsy report.—The deep cyanosis of the unembalmed body almost obscured the extensive purpuric rash. A cisternal puncture was performed prior to opening the skull and it was noted that the cell count had increased to 26 cells per cu. mm. with a number of polymorphonuclear leukocytes being present.

The meninges and brain appeared somewhat injected although no exudate was present. Smears from the pia showed an occasional pus cell and a gram-negative diplococcus identified as N. intracellularis.

Both adrenals were slightly enlarged and of a mottled dark red color. The cut surface revealed that they were engorged with blood and the demarcation between the cortex and medulla was lost. Microscopic study showed a marked capillary dilatation with small extravasations of blood in certain areas, which had resulted in a separation and crushing of the parenchymal cells, and in some areas a complete loss of tissue structure, though still too recent to effect cellular necrosis. In a few small areas the adrenal was quite normal in appearance and even the dilated capillaries were lacking. This profound capillary dilatation, or relaxation, was also observed in sections through the lungs, the glomerular tufts of the kidney, and the meninges.

It must also be assumed that this process probably occurred in the skin, through which no sections were taken, and thus could explain the extravasations which became purpuric areas.

Sections through the meninges showed in addition to the marked capillary dilatation, an early, although sparse, infiltration of polymorphonuclear leukocytes.

Cultures of the spinal fluid and the blood were positive for a maltose fermenting, gram-negative, diplococcus characteristic of Neisseria intracellularis.

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COMMENT

The case presented may reveal that so-called "medical shock" evinced by rapid circulatory failure is probably not a result of loss of hormonal secretion of the damaged adrenals as has been suspected or implied, but rather a loss of vascular tonicity due to the toxemia associated with the septicemia. The enormous and prominent capillary dilatation is observed in the adrenals, the glomerular tuft, the alveolar walls, and the meninges and is not marked in other organs, with the possible exception of the skin. It is notable that the blood supply to these four structures is inordinate and probably accounts for this seemingly selective action.

Further, it must be pointed out that two of these areas, the adrenals and the meninges, are selectively affected in meningococcemia and that the loss of vascular tone in the meningeal capillaries permits the extrusion of the elements in the blood stream carrying the N. intracellularis. Thus the meningitis is set up in a manner explaining such selective localization. This adds further refutation to the now rather generally outmoded theory that infection passes directly from the nasopharynx through the cribriform plate. It also explains why, if organisms are found, they apparently have only been found in the choroid plexus. Cultures, however, from the intraventricular fluid are often sterile in contrast to those from the cortical surface (*3*).

While in advanced cases of meningitis the distended meningeal vessels are obvious, it is not clear that this is not a secondary phenomenon. Observations on this present early case seem to indicate that this characteristic is of a primary nature.

Since, as noted by others (*1*), the adrenals are not constantly involved in meningococcemia despite the fact that marked hypotension and progressive circulatory failure exist, it must be assumed that this phase of the so-called Waterhouse-Friderichsen syndrome may be merely coincidental.

The fortuitous timing of this unfortunate case enabled us to note that while sufficient time had elapsed for the organisms to invade the spinal fluid from the distended and permeable meningeal capillaries, the interval had still not been sufficient to provoke any marked cellular reaction in the fluid. One must conclude that had the patient lived longer a purulent meningitis must surely have followed.

Intravenous sulfonamides are probably the only therapeutic agent in these cases which might prove life-saving, but by the time the cultural diagnosis is made their use has been delayed too long to be effective. It is recognized that in a large number of cases the blood smears from purpuric lesions will show organisms and permit a quick recognition of the etiology of the septicemia, while in others,

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leukocytes laden with suspicious diplococci may be observed by mere chance in the Wright's stained blood films. Utilization of the "buffy layer" smears for gram-staining permits a concentration of the invaded cells and free organisms not possible in other methods. Humphrey (*4*) has also used this device successfully in streptococcic septicemias and it has enabled early and rational treatment to be instituted long before the culture of the blood was reported. The limitations of this method should, of course, be realized in that if the bacteremia is not heavy it is not as satisfactory as would be a culture, and that in most instances it also lacks the positive identification made possible by a culture.

SUMMARY

A case of meningococcemia associated with bilateral adrenal hemorrhage is reported. It offers additional evidence in the refutation of the Waterhouse-Friderichsen syndrome as a clinical entity, and outlines the probable mechanism and pathologic changes in incipient meningitis.

A method for the rapid recognition of the causative organism in such septicemias, by means of smearing and staining a concentrate made from the buffy layer is described.

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RIGHT-SIDED AORTIC ARCH

REPORT OF A CASE

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Congenital defects of the heart and great vessels comprise only 1 to 2 percent of the total incidence of organic heart disease. Of these anomalies, right-sided aortic arch is one of the rarest. Abbott (*1*) lists 14 cases in a statistical analysis of 1,000 patients having congenital cardiac disease. The first cases diagnosed during life were reported by Assmann (*2*) in 1924. Brunetti (*3*) contributed 1 case in 1931; Sprague, Ernlund, and Albright (*4*) 2 cases in 1933; Friedman (*5*)

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2 cases in 1935; Metzger and Ostrum (*6*) 2 cases in 1939; and Eisen and Taub (*7*) 2 cases in 1941.

The origin of right-sided aortic arch reverts to the embryologic development of the great vessels. The human embryo possesses six pairs of aortic arches. The left fourth arch is eventually converted into the arch of the aorta. Variations of this normal developmental pattern have been noted. If the dorsal roots of the right fourth and sixth arches persist, and the corresponding parts on the left side disappear, the arch of the aorta is transposed from the left side to the right side. This is the usual occurrence in birds (*8*).

The majority of these cases are symptomless and are discovered accidentally. In some there is compression of the esophagus with dysphagia. This has led to the use of the term "dysphagia lusoria" as a synonym. The possibility of right-sided aortic arch must be considered in unexplained cases of dysphagia. The development of tortuosity of the aorta in later life may initiate symptoms in a previously asymptomatic individual.

Diagnosis is established primarily by roentgenographic evidence. The left aortic knob is absent in this condition and there is an opaque circumscribed area to the right of the spinal column in the region of the sternoclavicular junction. The trachea is deviated to the left. During fluoroscopic examination the circumscribed shadow is seen to pulsate. After a barium test meal the esophagus is seen to be displaced to the left and anteriorly, and a convex impression is noted on its right side. Occasionally a definite narrowing of the esophagus occurs. These displacements are of course due to the abnormal course of the aortic arch. The pulmonary conus and upper border of the left side of the heart may be visualized more clearly because the superimposed shadow of the descending portion of the arch is absent.

Other conditions that may be confused with right-sided aortic arch include mediastinal tumor, aneurysm, abscess, glandular masses, bronchial carcinoma and transposition of the great vessels. None of these conditions, however, shows displacement of the esophagus and trachea anteriorly and to the left. Anterior displacement of the esophagus at the level of the aortic arch is almost pathognomonic of an aortic lesion. Kerley (*9*) states that he has seen five cases of anterior displacement. Two were right-sided aorta, one was an aneurysm, one a spontaneous pneumothorax with rupture of the mediastinum, and one a mediastinal abscess complicating puerperal sepsis.

CASE REPORT

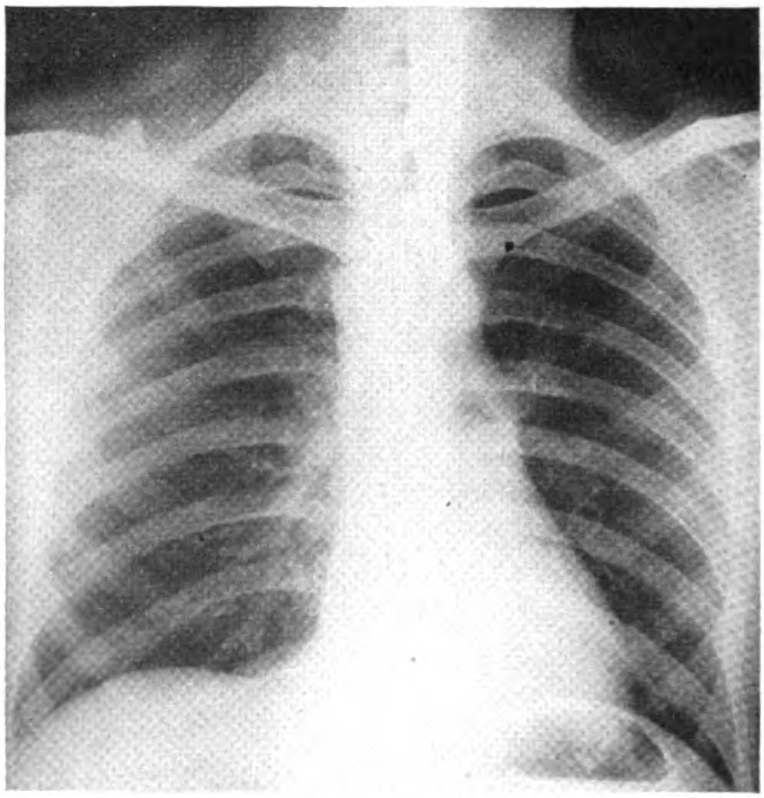
A 30-year-old seaman, second class, came under observation because of a persistent headache. There was no dysphagia or any complaint referable to the cardiovascular system. The family and clinical histories were irrelevant.

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Physical examination of the chest and heart revealed no abnormalities. Electrocardiographic and urine studies yielded normal findings. Roentgenograms of the chest revealed the trachea deviated to the left, absence of the aortic knob, a prominent pulmonary conus, and a smooth, round opaque area 3 cm. in diameter, just below and medial to the inner border of the right clavicle. Roentgenograms taken with a Bucky diaphragm clearly outlined this mass which was encroaching upon and displacing the trachea just above the bifurcation.

Fluoroscopic examination showed the mass to be pulsating. The barium test meal was well retained, and in the anterior position a smooth impression of extrinsic origin on the right side of the esophagus, causing a slight narrowing, was readily visualized. The esophagus was displaced to the left at this level (fig. 1). In the right anterior oblique position the esophagus was clearly displaced anteriorly by the aortic arch (fig. 2), and there was a smooth impression



1. An anteroposterior view shows the barium-filled esophagus deviated to the left.

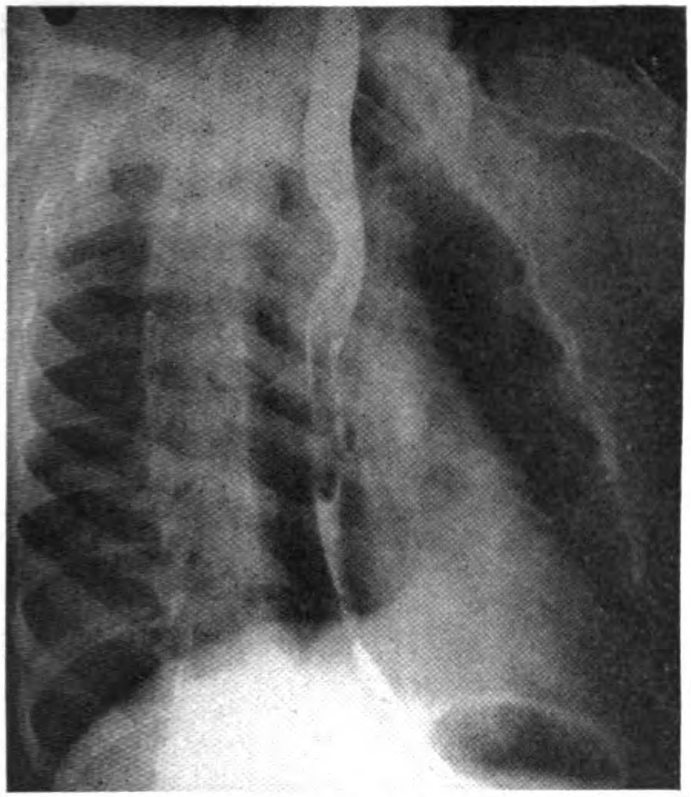
on the posterior wall of the esophagus resulting in a slight narrowing of its lumen. The trachea was slightly displaced anteriorly. In the left lateral position the esophagus and trachea were again visualized in their anterior displacement.

Further examination failed to reveal the presence of any other congenital anomaly in this patient.

CONCLUSION

A case of right-sided aortic arch is added to those reported in the medical literature. In this case the condition was asymptomatic and discovery was accidental. The diagnosis was established by roentgenographic examination.

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2. A right anterior oblique view reveals anterior displacement of the esophagus, with the impression of the aortic arch posteriorly causing slight narrowing of the esophageal lumen.

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RECTUS MUSCLE STRAINS SIMULATING ACUTE INTRAPERITONEAL DISEASE

51 CASES AT A NAVAL TRAINING STATION

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and
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The activities at a United States naval training station are very strenuous and in the course of training disabilities arise which are not so apt to occur as in civilian life. Certainly they never occur in great numbers. For this reason conditions such as severe rectus muscle strains may be incorrectly diagnosed.

In a 4-month period 51 cases of strain of the rectus abdominis muscle were observed at this activity. In 47 instances acute intra-abdominal disease was suspected, 40 of which were considered to be acute appendicitis. In another case the appendix had previously been removed and the tentative diagnosis was right diverticulitis. In table 1 are shown the number of cases, the admitting diagnosis and the muscle areas involved. It is interesting to note that the left rectus muscle was involved in only 7 cases, in one of which the involvement was bilateral. The upper portions of the recti muscles were affected in 2 instances. The average age of the patients was 20.7 years, and the average hospitalization period was 9 days. In the 4 cases in which an appropriate diagnosis was made upon admission there was a visible and palpable hematoma.

TABLE 1.—*Admission diagnoses and muscle area involved*

Admission diagnosis	Number of cases	Location of lesion			
		Rt. lower quadrant	Lft. lower quadrant	Rt. upper quadrant	Lft. upper quadrant
Appendicitis, acute	40	40			
Diverticulitis, right	1	1			
Cholecystitis, acute	1			1	
Traumatic hernia, right	1	1			
Traumatic hernia, left	1		1		
Gastritis	2		1		1
Dilatation of colon, acute	1	1	1		
Hematoma, traumatic	4	1	3		

The histories and clinical pictures upon admission were strikingly similar in all instances. After violent exercise such as "commando" training, scaling walls, swinging on ropes and the like, the patient would complain of severe lower abdominal pain. In some instances the pain was constant, in others intermittent or absent when the patient was lying quietly, but was always aggravated by motion involving the injured muscle. The affected area was extremely tender

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upon palpation. In the cases suspected of being appendicitis (those in which the lower part of the right rectus muscle was involved) the usual point of maximum tenderness was just lateral to and below the umbilicus. This area was always over the rectus muscle, decreasing markedly in tenderness over the adjacent oblique muscles. In fact, in the majority of cases palpation of the oblique muscles lateral to the rectus muscle produced no distress.

The parting of a group of muscle fibers in a strain is accompanied by hemorrhage which may be minute or extensive at the site of rupture. Consequently, due to hemorrhagic infiltration and protective muscle spasm, the involved rectus muscle evidences rigidity or "muscle guarding." Palpable hematomas were noted in 10 of the cases. Rebound tenderness over the injured area was often present.

In 20, or 39 percent of the cases, there were increased numbers of leukocytes in the blood. (More than 11,500 leukocytes per cu. mm. with a differential of more than 70 percent polymorphonuclear neutrophils was considered an increased count.) In 31 percent of cases anorexia, nausea, and vomiting were accompanying features. Temperature elevations ranging from 99.2° to 102.4° F. were observed in 21 cases or 41 percent. Protective inoculations may have accounted in part for many of the elevated temperatures. Upper respiratory infections were noted in 10, or 20 percent of the cases. The essential physical findings are listed in table 2.

TABLE 2.—*Physical findings*

Symptoms	Number of cases	Percentage of total cases	Symptoms	Number of cases	Percentage of total cases
Pain	51	100	Elevated temperature	21	41
Localized tenderness	51	100	Upper respiratory infection	10	20
Elevated white blood counts	20	39	Grossly palpable hematoma	10	20
Gastro-intestinal symptoms	16	31			

As a therapeutic procedure and a diagnostic test, 20 to 30 cc. of 1-percent novocain was injected into the lower portion of the right rectus muscle of 22 of those patients suspected of having appendicitis. The results were striking, the patients experiencing immediate relief from all symptoms for 1½ to 2 hours. Three of these cases are summarized (cases 1, 2, and 3). In 2 additional instances injections of novocain produced only partial relief. One of the latter 2 patients (case 4) was found to have a gangrenous appendix and the other a hydronephrosis on the affected side. One patient who experienced complete relief from a novocain injection was subsequently subjected to appendectomy because of a suggestive history and tenderness which extended out over the oblique muscles. A grossly and microscopically normal appendix was removed (case 5).

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CASE REPORTS

Case 1.—An apprentice seaman, 19 years old, was admitted to the dispensary with a diagnosis of acute appendicitis. After scaling a wall in "commando" training, he first noticed severe pain in the right lower quadrant of the abdomen. The pain disappeared when he was lying quietly, but was initiated by coughing, deep breathing, sneezing and other movements involving the right rectus muscle. He had had 5 watery bowel movements during the day. The blood count and urinalysis were within normal limits. The temperature was 99.2° F. Physical examination disclosed extreme tenderness to palpation, and rigidity over the lateral margin of the right rectus muscle about 5 cm. below the umbilicus. Palpation over the oblique muscles laterally produced no distress. Injection of the lower right rectus muscle with 24 cc. of 1-percent novocain produced immediate complete relief of symptoms for over 1½ hours. The patient was discharged to duty 6 days later with a diagnosis of strain, right rectus muscle.

Case 2.—An apprentice seaman, 22 years old, was admitted to the dispensary with a diagnosis of acute appendicitis. While climbing a rope the previous day, he had experienced sudden severe pain in the right lower quadrant of the abdomen. The pain had remained constant and was aggravated by movement involving the abdominal muscles. No gastro-intestinal symptoms were elicited. The patient's temperature was normal. The leukocytes in the blood numbered 12,150 per cu. mm., the differential exhibiting a shift to the left. The entire lower portion of the right rectus muscle below the umbilicus was extremely tender to palpation, the point of maximum tenderness being at the level of the anterior superior spine of the ilium. This area was firm and indurated. Aspiration of the lower part of the right rectus muscle produced 22 cc. of dark red blood. After injection of 30 cc. of 1-percent novocain, all symptoms disappeared and deep palpation of the area elicited no complaint. The patient was discharged 11 days later with a diagnosis of hematoma, traumatic, right rectus muscle.

Case 3.—An apprentice seaman, 17 years old, was admitted to the dispensary with a diagnosis of acute appendicitis. After lifting a heavy weight, he experienced severe pain in the right lower quadrant of the abdomen. The pain was greatly alleviated by the patient lying still, but became intense on exercise requiring the use of the abdominal muscles. The temperature was 99.4° F. There was a history of anorexia and nausea before onset of the pain, and of vomiting 2 hours later. Examination of the blood showed 18,750 leukocyte count with the differential count exhibiting a marked shift to the left. Physical examination showed evidence of a mild upper respiratory infection and extreme tenderness to palpation over the lateral margin of the lower portion of the right rectus muscle opposite the anterior superior spine of the ilium. Palpation of the oblique muscles in this area produced no pain. There was "muscle guarding" of the right rectus and some rebound tenderness. Injecting 28 cc. of 1-percent novocain into the lower portion of the right rectus muscle gave complete relief of symptoms for 1 hour. The patient was discharged 7 days later with a diagnosis of strain, right rectus muscle.

Case 4.—An apprentice seaman, 20 years old, was admitted to the dispensary with a diagnosis of acute appendicitis. Following a strenuous baseball game, the patient complained of pain in the right lower quadrant of the abdomen. He also experienced anorexia and nausea but no vomiting. The blood count and urinalysis were without normal limits. The temperature was 98.6° F. Physical examination revealed tenderness to palpation over the lower portion of both recti muscles but it was more pronounced on the right side. The point

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of maximum tenderness was the lateral margin of the right rectus muscle opposite the anterior superior spine of the ilium. Increased tonus of the lower part of the rectus muscle was noted. Rebound tenderness was not present, but there was tenderness to palpation over the lower oblique muscles on the right side. Twenty-five cubic centimeters of 1-percent novocain were injected into the right rectus muscle on its lower aspect but produced only slight relief of symptoms. The patient was operated upon and an acute suppurative appendix was removed.

Case 5.—An apprentice seaman, 25 years old, was admitted to the dispensary with a diagnosis of acute appendicitis. After swimming he experienced a severe right lower abdominal pain which was relieved in part by lying or standing quietly, and aggravated by movement. Anorexia and nausea preceded the onset of pain and continued for 12 hours. The patient's temperature was normal. The leukocytes in the blood numbered 13,450 per cu. mm., 78 percent of which were polymorphonuclear neutrophils. Physical examination disclosed extreme tenderness to palpation over the lower part of the right rectus muscle, the point of maximum tenderness being 3½ cm. below the umbilicus over the lateral margin of the muscle. Palpation of the oblique muscles in this region produced much less discomfort. The pain disappeared immediately after injection of 25 cc. of 1-percent novocain into the muscle, and deep palpation of the right lower quadrant of the abdomen caused no distress. Because of the persistent nausea, suggestive history, and tenderness of the oblique muscles, appendectomy was performed. A grossly and microscopically normal appendix was removed. Final diagnosis: Muscle strain, right rectus abdominis.

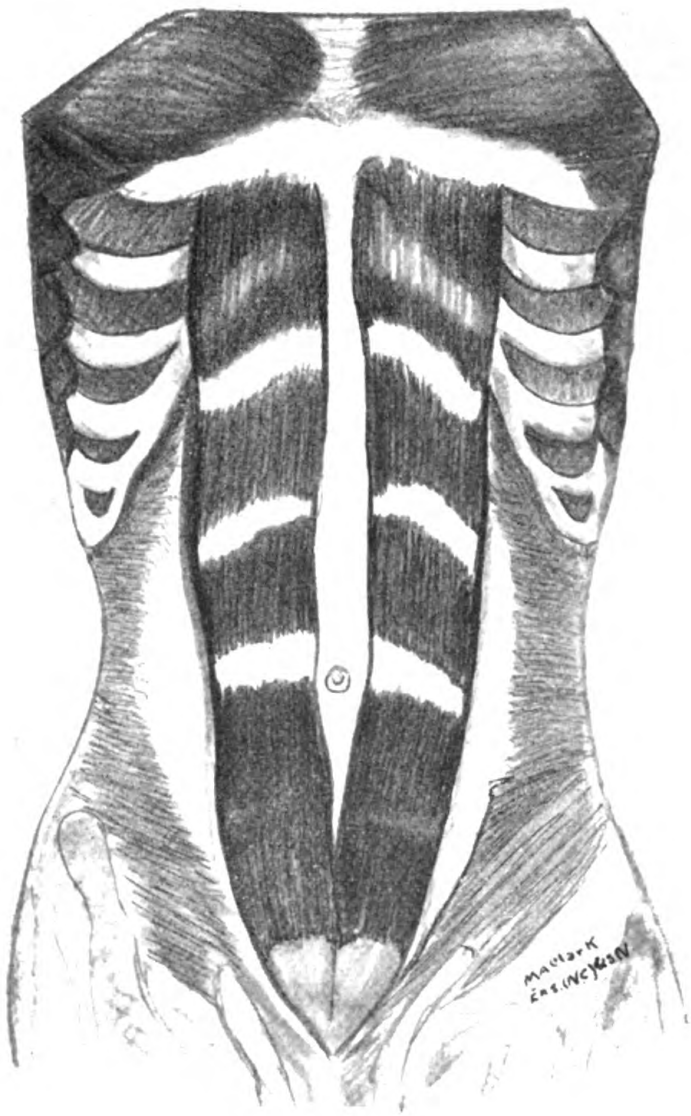
In order to understand strain of the rectus abdominis muscle, which in 96 percent of cases involves its lower portion, the anatomy of that muscle must be reviewed. The long, strap-like rectus abdominis muscle arises from the crest and symphysis of the pubis. The muscle expands in its upper portion and is inserted into the anterior surface of the xiphoid process and the superficial surfaces of the 7th, 6th and 5th costal cartilages. On its anterior surface, but not extending through the entire substance of the muscle, are 3 or more transverse tendinous intersections, each firmly adherent to the anterior wall of the sheath of the muscle. The lowest is at the site of the umbilicus and the highest near the xiphoid process. It would seem logical that the upper part of the rectus muscle, being reinforced by these tendinous intersections, is less likely to be overstretched in severe stress and arduous exercises than is the lower portion (fig. 1).

The sheath of the rectus is derived from the aponeurosis of the lateral muscles of the abdominal wall, which after enclosing the muscle, gives rise in the median plane to the linea alba. At the linea semilunaris along the lateral border of the rectus muscle, the aponeurosis of the internal oblique muscle splits into anterior and posterior layers. The anterior layer, joined by the aponeurosis of the external oblique muscle, passes in front of the rectus and forms the anterior lamina of the sheath. The posterior layer, joined by the aponeurosis of the transverse muscle, passes behind the rectus, constituting the posterior lamina of the sheath. Below the level of the

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superior anterior iliac spine, the sheath of the muscle is deficient posteriorly. In consequence, the rectus in the lower fourth of the abdominal wall rests directly upon the fascia transversalis (fig. 2).

Thus, in addition to the lack of tendinous insertions in the lower fourth of the rectus abdominis muscle, the sheath of the muscle is also deficient posteriorly in the same area. Both of these deficiencies predispose this site to strain.



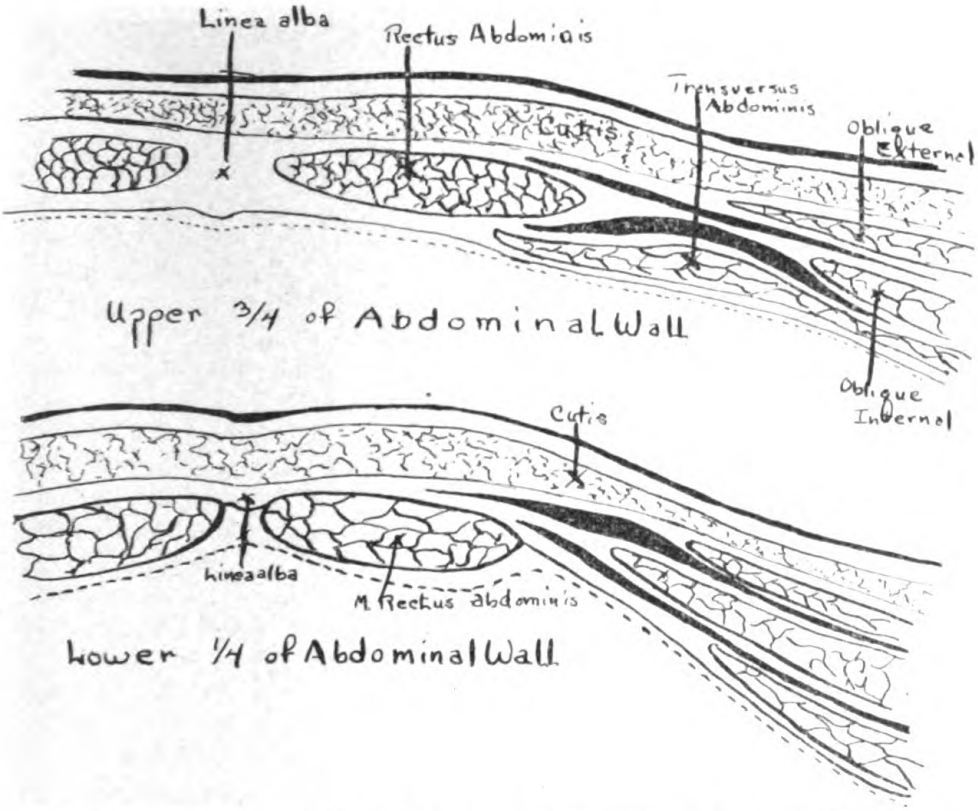
1. Anatomy of the rectus abdominis muscle.

Then, too, the tissues of the abdominal wall meet in the midline at the linea alba, making the medial aspect of the rectus abdominis muscle more strong and secure than the lateral, and predisposing the lateral region to strain.

We may well ask why 86 percent of these cases involve the right rectus muscle and only 11 percent the left. Perhaps the suspicion

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of appendicitis tends to impress the medical officer, and those patients complaining of right-sided pain are more apt to be referred to the dispensary, whereas those with left-sided pain cause less concern and may be allowed to remain on duty. Or the predominance of right-handed individuals may explain why more stress falls on the right rectus muscle during violent exercise. In favor of the first premise is that the average period of hospitalization for cases of left rectus strains was 20 days, while the average for all cases was 9 days, indicating that those on the left, when admitted, were more severe. Doubtless, however, both factors are significant.



2. Layers of abdominal wall showing relationships of rectus abdominis.

SUMMARY AND CONCLUSIONS

1. A series of 51 patients admitted to the hospital with strains of the rectus abdominis muscle is presented.

2. These individuals, usually admitted with a diagnosis of acute appendicitis, present a very real diagnostic problem.

3. Novocain infiltration of the affected muscle is a valuable aid in diagnosis.

4. The pathology of this type of injury is discussed with a possible explanation of its mechanism from an anatomical standpoint.

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A CASE OF HEPATOPTOSIS SIMULATING INTRA-ABDOMINAL TUMOR

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Lieutenant, junior grade (MC) U. S. N.

Congenital anomaly of the abdominal viscera is seldom cause for perplexity in the diagnosis of intra-abdominal tumors. It is even more rare that a congenitally misplaced ("dropped") liver, or hepatoptosis, should be considered in the differential diagnosis of a large tumor mass confined entirely to the lower portion of the abdomen. This case is reported to present such an anomaly.

CASE REPORT

A 22-year-old rigger's helper, was admitted to the hospital complaining of pain in the right lower quadrant of the abdomen, nausea and vomiting. The patient had first experienced a sensation of a "knot in the right side" a few hours previously. This was followed by a colicky type of pain which was generalized over the abdomen. He then became nauseated and vomited bile-stained material. He had had a normal evacuation a few hours before onset of the acute symptoms, and there had been no recent change in bowel habits.

The clinical and family histories were without significance. At the time of admission the patient was somewhat nauseated but in no acute abdominal distress. There was no evidence of abdominal distention, but the entire right side of the abdomen exhibited "muscle guarding" to palpation. There was some tenderness in the right lower quadrant of the abdomen but no rebound tenderness. Rectal examination did not reveal any masses or tenderness. Examination of the blood showed the concentration of hemoglobin to be 85 percent, the erythrocytes were 4,500,000, and the leukocytes 6,800 with a normal differential count. The urine was normal. A working diagnosis of subacute appendicitis was made.

The next morning the patient's temperature, pulse, and respiration were normal and the pain had disappeared. The blood count remained the same. A definite, movable mass which was firm but not tender could be palpated in the abdomen below the umbilicus. The mass seemed to fill the entire lower portion of the abdomen and persisted after an enema had been given and catheterization was done. Further questioning at this time disclosed that the patient had not been able to wear a tight belt or tolerate any constriction of his waist since childhood. Such constriction would cause a sense of fullness and some pain in the abdomen. He had suffered no recent weight loss.

On roentgenograms of the abdomen the outline of a tumor mass could be seen extending from the middle of the body of the second lumbar vertebra to the symphysis, and laterally to just within the psoas muscle. A considerable amount of gas was present in the small intestines which were displaced into the upper left quadrant of the abdomen by the tumor mass. A retrograde pyelogram showed no abnormalities of the urinary system except for a kinking of the right ureter about 1½ inches below the uretero-pelvic junction. There was also dilatation of the calices and ureter of this side, but no displacement of the ureters toward either side.

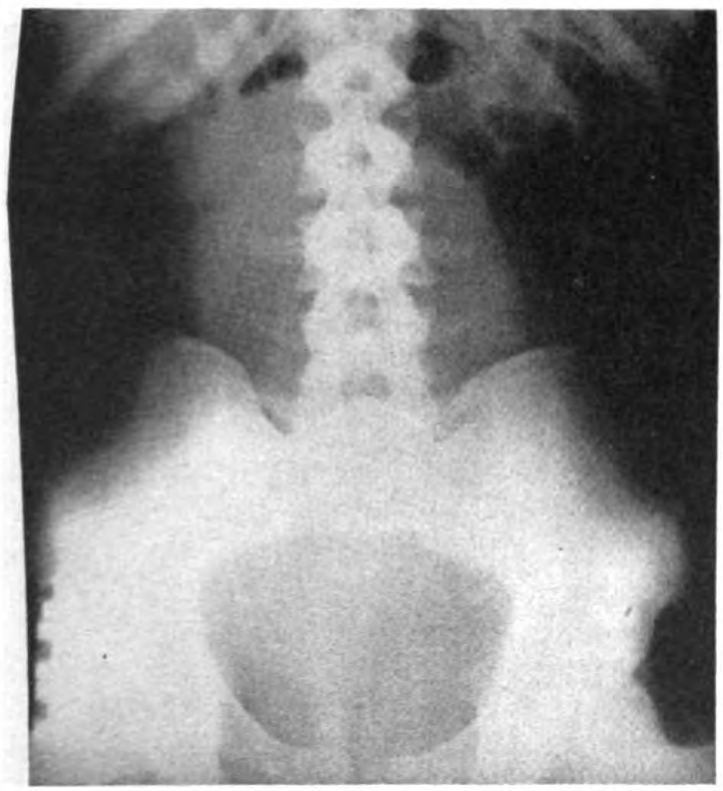
There was no roentgenographic evidence of intrinsic obstruction or filling defect of the gastro-intestinal tract. There was evidence, however, of the stomach being compressed and displaced upward to the left. Subsequent

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fluoroscopic examination of the chest revealed no evidence of pulmonary disease or enlargement of the hilar structures.

At this time an exploratory laparotomy was considered. The preoperative differential diagnoses included appendiceal abscess, retroperitoneal lymphosarcoma, Hodgkin's disease or similar malignant condition, omental and mesenteric cysts or lipomata, and pancreatic cyst.

Eight days after admission laparotomy was performed. The large "tumor" was found to be a displaced liver which extended from just above the umbilicus to the symphysis. The right upper quadrant of the abdomen was filled only with distended loops of intestine. The rounded superior surface of the liver could be palpated easily but its supporting structures could not be ascertained. All attempts at moving the organ with hepatopexy in mind were unavailing. The appendix was removed and the abdomen closed.



1. Roentgenogram of the abdomen in which the outline of the ptotic liver can be seen extending from the level of the second lumbar vertebra to the symphysis. The upper right quadrant of the abdomen is seen to be filled with a distended loop of intestine.

COMMENT

Hepatoptosis (movable or floating liver) may be either congenital or acquired. The case reported here was obviously of the congenital variety. Deaver quotes Clark and Doley to the effect that congenital movable liver may be due to the presence of a mesohepar. The latter is a double reflexion of the peritoneum from the upper lobe of the liver to the diaphragm. Albu in 1909 made a study of 94 infants ranging

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from 1 to 10 days old and found hepatoptosis present in 5 percent of the males and 9 percent of the females. Brown quoted Glenard as having found 51 cases of hepatoptosis in a routine study of 1310 patients.

It is believed that hepatoptosis of the extreme degree exhibited in this case is a very rare congenital anomaly.

RETINITIS PROLIFERANS (EALES' DISEASE)

WARD C. DENISON
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Retinitis proliferans or Eales' disease is characterized by recurrent hemorrhages into the vitreous body and retina. It usually occurs in young males between the ages of 18 and 30 years.

Henry Eales in 1880 gave the first adequate description of recurring retinal hemorrhages in young men. The fact that the left eye was most frequently involved he attributed to the anatomic condition of the vessels; those going to the right side take a more circuitous course and do not have a direct extension from the aortic arch.

At the onset of an attack it is often impossible to see the retina because of the clouding of the vitreous by extensive hemorrhage. When the vitreous has cleared it is sometimes possible to see the source of the hemorrhage at the site of the retinal veins. The veins may be irregular in size and dilated with a perivenous infiltration. The small branches may become obliterated and later show a proliferation of new vessels into the vitreous and retina. Detachment of the retina may follow retinitis proliferans.

Etiology.—Constipation, hemophilia, hyperthyroidism, and endocrine diseases were thought by early writers to be the etiological factors. It was first suggested in 1908 that tuberculous lesions of the retinal veins were responsible for the hemorrhages. Finnoff (*1*), Young (*2*), and others have since tended to agree with this theory. Recurrent hemorrhages into the vitreous and retina are rarely seen in association with clinical tuberculosis in other parts of the body. However, some ophthalmologists feel that the presence of a positive tuberculin test is sufficient proof for a tuberculous lesion of the eye.

In a series of 1,052 cases of diabetes mellitus reported by Wagener, Dry, and Wilder (*3*) recurrent hemorrhages into the retina and vitreous with retinitis proliferans occurred in 19. The localized lesions in the retinal veins which are the source of the hemorrhages are quite similar to, if not identical with, those seen in recurrent hemorrhages of Eales' disease, and retinitis proliferans is an almost constant sequela. The fact that this disease has occurred only in males strongly

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suggests that there is an important hereditary factor involved in its etiology. Marchesani (*4*) considered the intra-ocular hemorrhages a retinal disease with the manifestations of Buerger's thrombo-angiitis obliterans. The familial occurrence of the circulatory disturbances, which are to be considered as pathologically and pathogenetically uniform, suggests a hereditary anlage.

McArevey and Somerville-Large's (*5*) two cases improved under treatment with vitamin C. They believe retinitis proliferans to be a vitamin deficiency disease and state that it is relatively common in the west of Ireland. Spaeth and DeLong's (*6*) patient had progressive recurrent retinal hemorrhages associated with progressive periphlebitis of a high degree, signs of chronic iridocyclitis in the anterior segment, practically complete retinal separation, a hole in the macula and recurrent hemorrhages into the anterior chamber, with secondary glaucoma for which enucleation was finally necessary.

Hemorrhages in the retina or vitreous are usually of a traumatic, toxic or infective origin. Probably the most difficult factor to be ruled out is focal infection, such as that of the teeth, tonsils or sinuses. Systemic diseases such as syphilis, diabetes mellitus, cardiovascular renal disease, hypothyroidism and hyperthyroidism often associated with a calcium deficiency brought about by a diminished parathyroid secretion, have also been mentioned as causes of Eales' disease.

P'an (*7*) found a positive Wassermann in 1 of his 16 cases, 10 were positive to the tuberculin test and 2 had active pulmonary tuberculosis. He noted that the condition was most commonly found in the disc and very rarely in the periphery. The new blood-vessel formation in most cases was associated with the hemorrhages and exudation from the fundus, an inflammatory process he considered either luetic or tuberculous in origin. He felt it reasonable to assume that the disease is an end-result of the organization of vitreous hemorrhage, the process being similar to the production of new blood vessels in granulation tissue, in which after the blood clot has been absorbed there remains a network of new vessels supported by a fibrous tissue membrane.

Treatment.—The treatment of Eales' disease has been rather unsatisfactory. Some cases do very well without treatment and some respond very poorly to treatment. For many years potassium iodide was the favored drug but its effect on tuberculous lesions was questionable if not definitely harmful. Suggested treatments include the administration of tuberculin in tuberculous cases and calcium therapy, injections of whole blood and gelatin for the control of the bleeding in cases of undetermined etiology. Some authors believe that tuberculin therapy in proved cases of tuberculous origin is dangerous because of the risk of focal reactions in the eye and increased

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hemorrhages. Favorable results have been claimed for the nonspecific use of arsphenamine as well as for the intravenous injection of gold sodium thiosulfate. P'an (*7*) obtained improvement in a few cases by the use of tuberculin, subconjunctival saline injections and the application of radium.

Few marked improvements have been reported. Paton (*8*) reported two cases of Eales' disease with recovery of normal vision in one, and two-thirds normal vision in the other in spite of a partially vascularized vitreous.

CASE REPORT

A 23-year-old shipfitter, third class, was first seen at this hospital in May 1943, complaining of blurring of the left eye for the past 3 months with a gradual diminution of vision. Four days previously there had been a sudden clouding of the right eye so that all objects appeared hazy.

The patient had had two attacks of malaria during early youth, but there was no history of hemoptysis or of other symptoms suggesting any form of tuberculous infection. There was no history of other general disease or of injury. His mother died of diabetes mellitus.

General physical examination and external examination of both eyes revealed nothing pertinent to the case. Visual acuity, according to Snellen's chart, was 20/50 in the right eye and 10/200 in the left. This finding was not improved after refraction. The visual fields were greatly contracted, and the fundus of the right eye showed the disc to be very indistinct. There was a large organized blood clot in the superior region with stringy clots extending into the vitreous.

The fundus of the left eye showed extensive old hemorrhages involving the disc, macula, and a large area of the retina. The disc was very indistinct. There was evidence of a healing process with new blood-vessel formation in the vitreous. The veins were markedly engorged while the arteries were much contracted. At many places the blood column was almost invisible. Along the superior temporal branch of the central vein were found many small areas of previous hemorrhage. They were surrounded by a white exudate and interlaced with fine, newly-formed blood vessels in a thin circular membrane which penetrated into the vitreous.

The blood platelet count, analysis, coagulation, bleeding time, icterus index, and blood fragility were all within normal limits. The concentration of sugar was 92 mg. per 100 cc. of whole blood. Reaction to the Kahn test was negative. Urinalysis yielded negative results; blood urea nitrogen was 8.0 mg. The spinal fluid was within normal limits and reaction to a tuberculin test was negative.

The patient was in the hospital for observation from 27 May to 5 August. During that time the visual acuity of the left eye diminished from 10/200 to 2/200. There were no new hemorrhages in the left eye, but weekly retinal vein hemorrhages involving the macular and disc regions occurred in the right eye for 7 weeks. The blood clots of the vitreous completely resolved, but the visual acuity of the right eye had diminished from 20/50 to 20/100. No fresh hemorrhages were observed for 3 weeks.

There was no noticeable improvement following treatment with vitamins A, B, D, and G, ascorbic acid, calcium lactate, calcium gluconate, or potassium iodide, and no cause could be found for the hemorrhages.

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IMMEDIATE SKIN GRAFTS ON FINGER INJURIES

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Fingertip amputations are quite common and present a distinct treatment problem. With this type of injury it is usually impossible to undercut the skin edges so as to close the defect without excessive tension. Furthermore, sacrificing length of the digit in order to obtain closure flaps is often inadvisable for functional, cosmetic and psychologic reasons.

Treatment by cleansing and applying sterile ointment dressings will usually result in the development of a bed of granulation tissue with epithelization beginning at the edges. Pinch grafts or Thiersch's grafts may be applied if necessary. This latter procedure, however, is apt to lead to excessive formation of tender scar tissue which is not resistant to the trauma normally tolerated by the skin of the hand. Pain is usually marked and the grafts are apt not to take well because of low-grade, secondary, pyogenic infection. Healing time may be prolonged and uncertain. Treatment by prompt cleansing or debridement of the wound and the immediate application of a skin graft will give better results in selected cases.

The types of grafts most useful in these cases are the free full-

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thickness graft and the pedunculated graft. The former is useful in injuries which after debridement have a highly vascular, clean area with enough superficial tissue to protect the bone from pressure. Skin for this type of graft may be obtained from the inner aspect of the upper arm. It is essential to make the free graft about one-fourth larger than necessary to cover the space, thus avoiding the necessity for excessive tension. The technic of its application includes the following steps.

Technic of applying free skin graft.—A local subcutaneous infiltration anesthetic is administered and the skin area to be removed is marked lightly with the point of a knife. Sutures (No. 000 silk) are inserted around the edges of this donor area and clamped with hemostats. The sutures can be used for traction and obviate the necessity of handling the graft with forceps. The graft is then removed, excess subcutaneous fat being discarded, and is immediately sutured to the defect. Number 000 silk is used for the purpose, the sutures being inserted from the graft into the finger. A sterile gauze pressure dressing with sponge rubber is then applied and left undisturbed for 10 days, when the sutures are removed and a dry dressing applied. If a crust has formed over the graft it should not be disturbed; in a few days it may slough off revealing fresh epithelium. Strict asepsis and extreme gentleness in handling are essential. The donor area may be closed by any appropriate method.

Technic of applying pedunculated graft.—A pedunculated graft is useful if more than superficial soft tissue has been lost and it is necessary or desirable to reconstruct any part of a finger. The pedicle of this graft may be raised from the chest or abdomen, the donor area being selected with a view to the nursing facilities available. It should be so planned that arterial patterns are utilized and enough fat is included to allow for atrophy of as much as 50 percent of the engrafted fatty tissue. Whether a single or double flap is used depends on convenience.

The injured area is thoroughly cleansed and, if necessary, debrided, and the graft is applied. The flap defect should be closed as much as possible without embarrassing the circulation of the flap. Finally, the arm is immobilized by an appropriate bandage. After 10 days to 2 weeks the pedicle is severed and the donor defect repaired. When the area is clean and circulation has been definitely established the graft may be "tailored" to produce a normal contour.

CASE REPORTS

Case 1.—A seaman, second class, was admitted to the sickbay a few minutes after the tip of his right second finger had been cut off in a slicing machine. Examination showed the tip of the finger to be cleanly amputated through the distal portion of the fingernail, distal to the terminal phalanx. A flat area about the size of a dime at the fingertip was devoid of skin. After thoroughly

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scrubbing the hand with soap and water, the wound was trimmed and irrigated with sterile normal saline solution. A free full-thickness graft was then applied as previously described. The patient felt little pain following this operation; after the first day the finger was painless. On the 9th postoperative day the dressing was removed and the graft was found to be covered by a thin brown membrane. This membrane separated spontaneously the next day and the graft was found to have good circulation. The patient was discharged to duty on the 12th day and all dressings were omitted 1 week later. Three months later the patient had a normal appearing fingertip except for a slightly increased vascularity in the grafted skin and absence of the usual characteristic fingerprint pattern. There was no tenderness.

Case 2.—A seaman was admitted to the sickbay a few minutes after injuring his right thumb while picking up a broken coffee cup. Examination showed the tip of the right thumb to be amputated in such a way as to leave a defect the size of a dime at the tip. A full-thickness graft was applied. On the 8th postoperative day the dressing was removed and the graft was seen to have an adequate circulation. The sutures were removed and dry dressings applied. The patient was discharged to duty on the 14th day. One month later the fingertip was slightly tender to deep pressure but this did not interfere with the patient performing his ordinary duties. Transfer of the patient prevented a follow-up of this case.

Case 3.—A seaman, second class, was admitted a few minutes after his right thumb was injured when he reached into a bread-slicing machine. Examination showed that the distal part of the end of the thumb on the palmar aspect as well as about one-fourth of the total bony substance of the terminal phalanx had been amputated. The wound cut across the nail just distal to the lunula on the inner border and left the end of the nail intact at the outer border. The remaining distal portion of the terminal phalanx was fractured transversely. Tissue loss included the skin and subcutaneous area over the distal half of the distal phalanx on the palmar aspect.

Under local digital block anesthesia the wound was immediately irrigated and debrided. It was decided not to remove the nail and the nondetached fractured distal portion, as this would have resulted in a loss of length. A single-pedicle graft was raised from the abdomen and sutured to the defect. Sulfanilamide powder was applied to the area and a flannel bandage reinforced with adhesive tape immobilized the hand. Ten days later the flap was separated from the base of the pedicle and the donor area was closed in a Y-shape. The severed end of the finger bled freely, proving that circulation had been established, but the area soon became cyanotic. It was treated with application of wet 1:5,000 acriflavine dressings. Ten days later the distal one-fourth had sloughed, but the rest of the graft appeared healthy. The abdomen had healed uneventfully. The thumb also healed over completely without need for any further plastic surgery and the patient was discharged to duty 34 days after injury. At this time bony union had been obtained.

Approximately 4 months after the injury occurred, a V-shaped depression on the thumb was excised and the edges approximated, restoring a normal contour to the digit. There is a loss of about 0.5 cm. in length, but the thumb is functionally satisfactory.

SUMMARY

Three incised wounds of the hand resulting in the loss of skin and soft tissue from the tips of the thumb and fingers were treated by

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immediate skin grafts with satisfactory results. The surgical principles emphasized in these cases are:

1. The immediate application of skin grafts to prevent the development of low-grade sepsis which occurs on any denuded area.
2. The use of fine sutures and atraumatic technic.
3. The necessity of adapting the type of skin graft to the individual case.
4. The use of a fixed, strictly aseptic operating technic even for so-called minor injuries whenever practicable.

ZOSTER WITH VARICELLIFORM ERUPTION

REPORT OF A CASE

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While cases of zoster with so-called varicelliform or hematogenous lesions are not rare, they represent an interesting problem in the question of immunity to virus disease. It has been claimed that individuals who have had chickenpox in childhood do not as a rule develop herpes zoster, which occurs principally in adults; also, that zoster in adults represents a partial immunity or resistance to the virus of chickenpox. This immunity is presumably based on subclinical disease in childhood, or in the absence of previous subclinical disease, upon maturation factors. As a corollary, the viruses of chickenpox and zoster are either identical or very closely related.

In the case to be reported here herpes zoster accompanied by a generalized varicelliform eruption occurred in a man who had not, so far as could be elicited, had chickenpox.

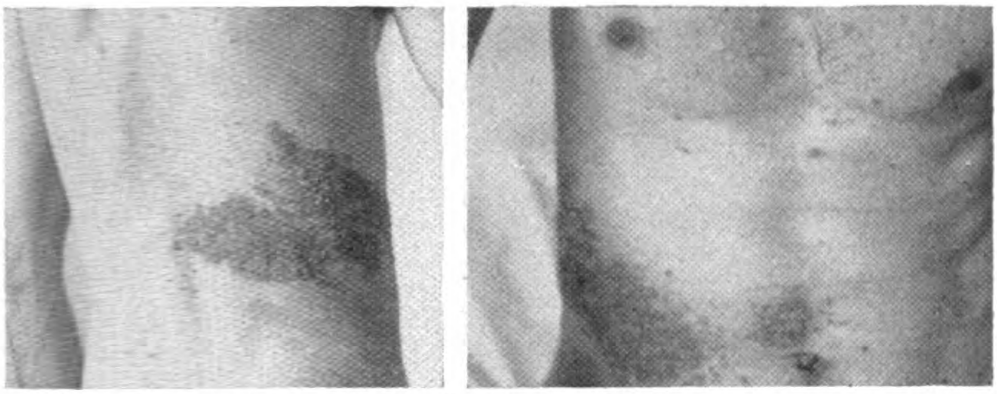
CASE REPORT

A 31-year-old white male developed an eruption on his right flank which was preceded and accompanied by intermittent, deep, stabbing pain in the region of the eruption, radiating from the midline anteriorly around to the back. He was admitted to the hospital several days later.

The eruption consisted of a thick band of confluent groups of tense, umbilicated, turbid, small bullae and vesicles on an extremely erythematous base. The band ran from the midline anteriorly around the right flank between the lower costal margin and the umbilicus to the midline of the back. The involved sites and the adjacent skin were hyperesthetic. This eruption was followed shortly by a moderately profuse, generalized outbreak of small turbid vesicles in several rapid crops. Some showed slight umbilication and had very fine erythematous halos.

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The patient's temperature ranged from 101° F. to normal for a period of 5 days. At the end of 4 hospital days no new scattered lesions had appeared, although many which were originally tiny, erythematous macules during the period of eruption had evolved into turbid vesicles and small bullae. The zoster band was full-blown although some of the bullae were becoming flaccid. The patient was discharged within 30 days, all of the lesions having disappeared except for a patch of crusts and scales below the right anterior costal margin in the site of the zoster band.



1. Showing vesicular band extending from midline posteriorly to midline anteriorly and some scattered vesicles.

COMMENT

Whether or not varicella and zoster are caused by the same or a similar virus and related immunologically, the clinical picture of zoster with generalized vesiculobullous lesions represents a hematogenous spread from the original zoster site and cutaneous localization of a dermatotropic virus. As such it manifests enhanced virulence of the virus, or lowered host resistance, and may be an intermediate stage between varicella and uncomplicated zoster.

YAWS

REPORT OF A CASE APPEARING IN A WHITE MAN

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One of the most common diseases peculiar to the tropics, this including the islands of the South Pacific, is yaws. Fortunately this disease rarely affects white men, although the incidence of infection among the natives is very high, probably exceeding 80 percent of those under the age of 15. As the result of an extensive educational program the majority of cases are treated, although often not until

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after the highly infectious, secondary eruption appears. This delay is caused by a persistent native superstition that it is better not to obtain treatment early. Many cases go entirely untreated, maintaining a reservoir of potential infection for weeks.

These conditions are important to the health of the white man living in the tropics in close contact with natives. However no case of yaws had been observed in our troops in this area prior to the present time, 17 months after the arrival of large numbers of service personnel. The following case is reported in view of this rarity and to emphasize the fact that white men are not immune to this tropical disease.

CASE REPORT

A 20-year-old staff sergeant, USMCR, was admitted to the field hospital complaining of persistent sores on his penis and elsewhere on his body. He was American born of Italian parents. His family history was otherwise unimportant. His past history was entirely irrelevant prior to his arrival in the tropics. Since then he had had a superficial, impetiginous dermatitis in the axillae, fungus infection of the feet and frequent minor follicular infections over the hairy parts of his body. He denied ever having had a venereal disease, a previous penile lesion, or other symptoms suggesting the possibility of a luetic infection. A month prior to admission, a blood Kahn reaction was negative.

He stated that he had been in the tropics in a duty status in the same general area for 15 months and had never had outpost or other duty that would place him in close contact with natives. He did, however, often visit with native friends in their homes and occasionally fondled native children, although he did not recall ever handling one with obviously open skin lesions or ever having been scratched by a child. Because of his work as an aviation mechanic, however, he practically always has minor cuts and scratches on his hands and forearms. He related that flies in the area in which he worked were a continual annoyance to himself and to the other mechanics. He steadfastly denied sexual intercourse with native girls at any time.

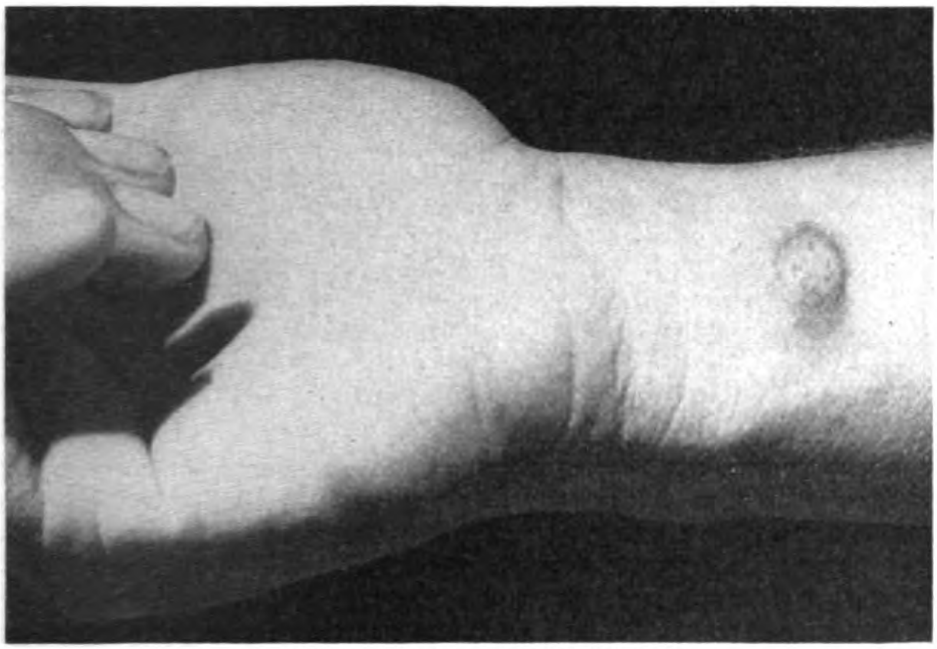
About 4 months prior to admission he developed a painless "sore" on the flexor surface of his right wrist. This was treated at the local sickbay as an ordinary staphylococcic infection of the skin, but despite treatment it failed to heal. Between treatments a heavy crust formed over the lesion, and when the crust was removed a shallow crater with elevated borders and necrotic base was disclosed. A clear, serous fluid exuded from this ulcer. Because treatment of the ulcer failed to bring about improvement, the crust had not been disturbed for about 1 month.

Approximately 5 weeks before coming to the hospital the patient noticed a painless, incrusted nodule about the size of a matchhead on the ventral aspect of the penis near the base, and he again reported to the sickbay. The crust of this ulcer was removed revealing a small crater which discharged pus and serum. The patient was advised to soak the penis in hot solutions and to apply various prescribed ointments. About the same time that the penile lesion appeared he noticed an itching sensation in the gluteal furrow, and shortly thereafter another painless ulcer developed in this location. During the next 5 weeks the penile and gluteal-furrow ulcers increased in size and similar ulcers appeared on the 5th finger of the right hand, in the right palm

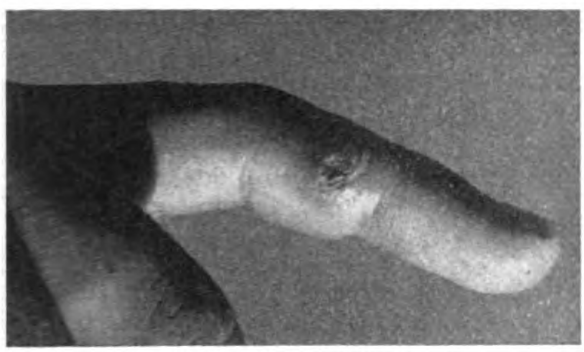
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at the base of the thumb, in the left popliteal space and on the soles of both feet. By the time of admission there were additional lesions on the right cheek, on the chin, and just inside the right nostril.

Physical examination revealed nothing of note except a generalized lymphadenopathy, which included the epitrochlear glands, and the skin lesions. There were no lesions on the mucous membranes of the mouth, throat, or on the tongue. On the flexor aspect of the right wrist there was a raised, heavily-crusted, oval nodule measuring ⅜ by 5/16 inch (fig. 1). When the crust was



1. Primary lesion ("mother yaw").



2. Secondary lesion.

lifted a dry, elevated, granulomatous base, purplish in color, was revealed. The surface was finely granular, somewhat resembling a raspberry. No serum could be expressed. Near the base of the penis and on its ventral aspect was a lesion having the appearance of a typical chancre. The nodule was firm, with raised, pinkish-gray borders. The center was depressed and ulcerated, having a foul, necrotic base which exuded a clear, serous fluid. It measured ½ inch in diameter and was roughly circular in shape. The ulcer in the gluteal furrow was covered by a heavy, yellow crust. When the crust was removed, the appearance of this ulcer was similar to that of the penile lesion, except that it was slightly smaller and somewhat reddened at the margin.

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The serous exudate quickly formed another crust. On the inner side of the 5th finger of the right hand was another roughly circular, incrusted lesion about ¼ inch in diameter (fig. 2). Under the crusts a small ulcer with a dirty, moist granular base was found. The palmar and plantar lesions on the right cheek, chin, inside the right nostril, and on the leg were about 3/16 inch in diameter, round, covered by a thick, caseous crust and surrounded by a fine, red areola. Similar ulcers to those described were found upon removal of the crusts.

Repeated darkfield examinations were made on the serum from the lesions on the penis, face, finger, buttocks and leg. All were positive for spirochetes morphologically identical with T. pallidum. Four attempts to demonstrate spirochetes in the tubercle on the wrist were unsuccessful. Practically no serum could be obtained although the granuloma was scraped and squeezed.

The blood Kahn was four-plus on the day of admission and again on the following day. Results of a complete blood count and urinalysis were essentially negative.

During the next 8 days numerous additional lesions appeared on the face, back, chest, abdomen, legs, arms, palms, and soles. These lesions were all essentially alike, beginning as small, round, elevated, reddish papules which quickly broke down in the center and became covered with an adherent, caseous crust. The lesions were encircled by a narrow zone of erythema.

Specimens for biopsy were taken from the initial lesion on the wrist and from one of the secondary lesions on the leg which had been proved positive for spirochetes by darkfield examination. The necessary stains for demonstrating spirochetes were not available, however. Pathologic examination of two specimens showed them to be grossly elliptical pieces of skin, in the centers of which were elevated, incrusted tubercles about 2 mm. above the surrounding epithelial surfaces. On sectioning, the tubercles seemed to be quite superficial. Microscopic examination revealed that both were histologically identical. The tubercles were composed of hyperplastic stratified squamous epithelium with considerable acanthosis in the deeper rete layer. There were areas of degeneration in the thickened epithelium, and numerous intra-epithelial abscesses containing some leukocytes and debris. Beneath the epithelium were dense accumulations of plasma cells and many lymphocytes. Eosinophilic leukocytes surrounded the lesion. Fibroblasts were present as well as small clusters of elongated cells resembling the epithelioid cells commonly found in granulomata.

Beneath the epithelium were small areas of hemorrhage, and between the deeper infiltrating epithelial pegs were aggregations of leukocytes and miliary abscesses. These histologic changes were identical with those seen in several proved cases of yaws in the generalized stage and were consistent with the diagnosis of this disease. The lesion on the right wrist was considered to have been the primary or "mother" yaw.

A treatment regime was outlined as follows: Ten intravenous injections of neoarsphenamine and 10 intramuscular injections of bismuth salicylate to be given concurrently, the first 3 injections at 4-day intervals, the remainder at intervals of 1 week. This was to be followed by alternating courses of bismuth and neoarsphenamine in 10-injection series until a total of 40 bismuth and 40 arsenical injections had been given. Subsequent treatment would be determined by the blood Kahn reaction.

On the first day of treatment 0.6 gm. of neoarsphenamine was administered intravenously and 0.13 gm. of bismuth salicylate intramuscularly. Three injections were given at 4-day intervals. Following the second injection there was marked healing of the lesions. Two days after the third injection all tubercles

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were completely dry although still visible, and the patient was removed from isolation. Three days after the third treatment a generalized, dusky red, somewhat blotchy, maculopapular eruption appeared. The rash was not itchy and was not accompanied by fever or other constitutional reactions. Within 24 hours it had completely disappeared. The interval between injections was then increased to 1 week. For the fourth treatment 0.2 gm. of neoarsphenamine and 0.13 gm. of bismuth was given. On the following day the rash reappeared, persisted for 12 hours, then faded away. It was then apparent that the patient was sensitive to neoarsphenamine and it was planned to administer a small test dose of mapharsen. Before the next treatment day, however, the patient was transferred to another activity.

At the time of transfer, 21 days after starting treatment, all the lesions were healed. Slightly depressed, glossy scars were the only remaining evidence of the disease with the exception of the primary lesion on the wrist. A purplish, slightly granular area marked the site of this original lesion. The area was smaller, however, and no longer elevated.

DISCUSSION

During a 17-month period, in an area where yaws is prevalent, no case of yaws or anything resembling this tropical disease had been observed in service personnel prior to the present time. As an indication of the remarkable rarity with which yaws occurs in white men, we are informed that only one instance has been observed in this area in the past 20 years. During the 17-month period also the only cases of primary syphilis in service personnel were those in which the initial infection had been contracted within the United States. White physicians who practiced in the tropics for many years stated that they had never seen a case of syphilis among the natives of this particular group of South Sea Islands. While these observations are not proof that syphilis does not exist in this locality, they certainly indicate that the disease is very uncommon. The possibility that syphilis has recently been introduced into these islands is not excluded.

In the case reported here, a 14-month absence from the United States would preclude the possibility of a luetic infection contracted by the patient prior to his coming to the tropics. The venereal history (negative in this case) assumes secondary importance in view of the appearance of the chronic, painless, granulomatous, raspberry-like lesion on the wrist 3 months before the ulcer appeared on the penis.

The fact that the primary ulcer had progressed to an advanced stage of spontaneous healing before the patient was first observed made it impossible to identify spirochetes in the lesion. That this lesion was not a manifestation of some totally unrelated condition is indicated first by the pathologist's report noting the similarity between this and a secondary lesion proved positive for spirochetes, and second, by the rapid reduction in size of the tubercle under treatment. The location of the primary lesion on the wrist does not

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of itself necessarily argue against its being a chancre. However, the gross appearance of this and of the lesions of the secondary eruption, with the exception of the penile ulcer, accurately fits the descriptions of the lesions of yaws as reported by Stitt (*1*) and as observed by us in natives suffering from the disease. The distribution of the lesions, particularly in the gluteal furrow and in the nostril, probably the result of direct contamination by the fingers, is also in keeping with the diagnosis.

The absence of lesions on the mucous membranes of the mouth and throat favors yaws but does not exclude syphilis. The penile ulcer bore a striking resemblance to a chancre and differed from the other lesions of the secondary group by being continually moist instead of crusted and dry. It was ascertained from the history that the ulcer on the penis was originally covered by a yellow crust as were the other lesions. The failure of a new crust to form after the first was removed can probably best be explained by the fact that the area at the base of the penis is in constant contact with the scrotum, resulting in continual friction.

The positive Kahn blood reaction and the finding of spirochetes in the lesions morphologically identical to T. pallidum provided the evidence necessary to complete the clinical diagnosis. T. pertenue of yaws and T. pallidum of syphilis cannot be differentiated under the microscope. Finally, the microscopic findings from both the primary and secondary lesions were similar to those commonly described in yaws.

Neoarsphenamine and bismuth salicylate have both been found effective in the treatment of yaws, the former being the drug of choice. Natives usually receive 3 injections of neoarsphenamine at weekly intervals, this amount being sufficient to bring about healing of the primary and secondary lesions. Tertiary lesions almost uniformly appear in these cases within a few months or years and likewise quickly respond to a course of 3 or 4 injections of the arsenical. In these cases the blood Kahn or Wassermann is never diagnostic. Gotay, Costa Mandry, and Payne state that the blood Wassermann remains positive in about 50 percent of cases after 3 years of intensive treatment with neoarsphenamine.

A long-range plan of treatment had therefore been suggested in this case, employing both neoarsphenamine and bismuth salicylate and in general following the same course that would be recommended in the treatment of syphilis. The Kahn reaction at the end of the course of treatment would be the determining factor as to what further therapy should be carried out. Unfortunately the patient proved to be allergic to neoarsphenamine. It is hoped that he will tolerate mapharsen and that this drug will prove equally as effective as neoarsphenamine.

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MEDICAL AND SURGICAL DEVICES

THE TOPICAL USE OF MEDICATED HUMAN PLASMA IN THE TREATMENT OF BURNS

MELVIN D. ABBOTT
Commander (MC) U. S. N.
and
JOHN R. GEPFERT
Lieutenant (MC) U. S. N. R.

The exudation of serum is the first defensive and reparative mechanism resorted to by the body following surface burns. In the absence of denudation, this exudation results in the formation of vesicles, so that the surviving tissue beneath has ample opportunity to regenerate unmolested. In the presence of denudation, the exudate spreads and covers the injured surface, serving as a protective and sedative layer of insulation. It is highly probable that it also acts as a nutrient medium for isolated surviving epithelial cells. Experience has shown that modification of, rather than substitution for, such natural reparative processes produces the best therapeutic result in most types of tissue damage. The usefulness of the above described natural protective mechanism in burns is limited, due to the lack of bactericidal activity sufficient to control secondary infection.

With these thoughts in mind, a 5-percent solution of sulfanilamide suspended in human plasma was prepared. Two-percent tragacanth was added, to make the mixture thick enough to facilitate application. Burn areas were first treated with soap and warm sterile water, then flushed with sterile normal saline. No vesicles were opened. A thick layer of the plasma-sulfanilamide solution was applied over the entire area. Two thicknesses of gauze were superimposed, and the entire area covered with waxed paper, secured along all edges to healthy skin by the use of adhesive strips. A pressure bandage was seldom used.

At the end of each 24 hours following the original dressing, a small portion of the adhesive was elevated and sufficient saline introduced to dampen the burn area and the overlying gauze. In the smaller burns, this was accomplished by the use of a large needle and Luer syringe. In the larger, a catheter may be placed so that fluid can be introduced without molesting the dressing. The introduction of additional plasma by this method apparently is not necessary, but saline is necessary to keep the dressing moist. All cases showed rapid loss of fluid from the dressings in spite of meticulous efforts to

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prevent evaporation. This brings up the question of fluid absorption from burn areas, a problem which we are not equipped to investigate.

Bearing in mind Winnett Orr's thesis that tissue rest results in tissue repair, we did not change the dressings on the majority of these patients until the 5th day. Splinting was practiced when feasible.

Ten patients with a total of 12 burns were treated as described above. All burns were second-degree, some with vesiculation. These burns involved the face, shoulder, legs, and, in 2 cases, the entire hand. None covered more than 3 percent of the body surface, according to Berkow's classification. The shortest period required for healing was 4 days, the longest 7, and the average 5. Only one area showed evidence of infection, and this was easily eliminated. This infection appeared following the removal of the dressing by the patient on the 2d day.

The results were very definitely better than those obtained by the use of any one of the many methods in vogue during the past 2 years. This conclusion is based upon a wide experience in the treatment of burns by the tanning, ointment, jelly, triple dye, and saline wet pack methods. Epithelization was rapid, granulation was minimal, and the adjacent skin retained a normal appearance, as contrasted to the maceration or desquamation which usually results from the use of oily or coagulating agents.

IDENTIFICATION BY MEANS OF DENTURES

FRANK E. JEFFREYS
Lieutenant Commander (DC) U. S. N.

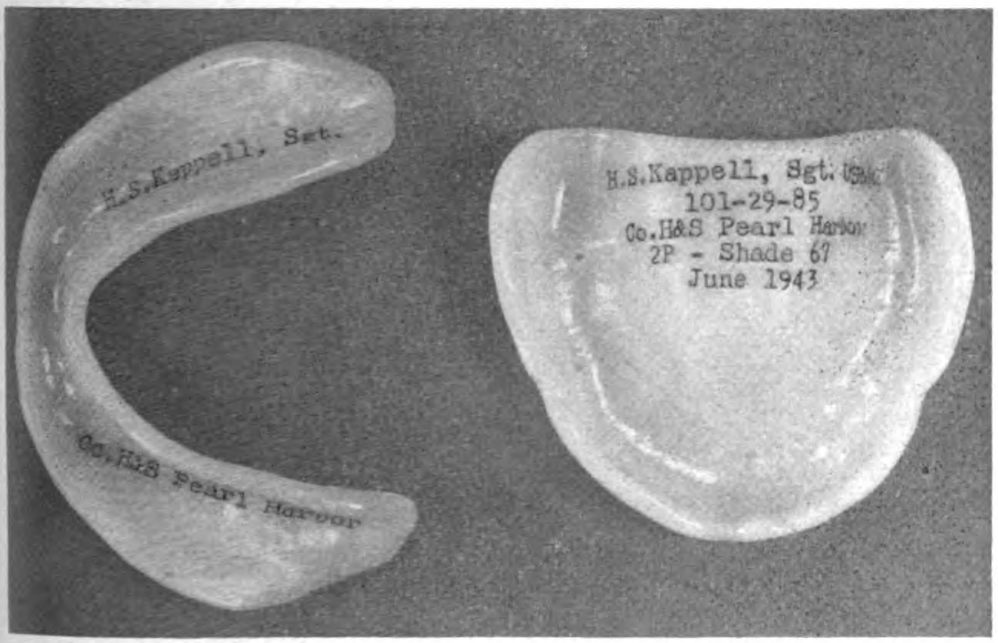
The purpose of this paper is to present a practical means of oral identification, where natural teeth are missing, by having the patient's name inscribed on the artificial dentures which replace the missing teeth. The Manual of the Medical Department, paragraph 2312 (d), states:

> When a body has been subjected to conditions which cause decomposition of tissue, the dental record may become the only means of arriving at a positive identification.

Any medical or dental officer who has had to identify a decomposed or mutilated body knows the difficulty encountered, and appreciates the importance of an accurate and neat dental abstract. While it is never an easy job to identify a body by checking the mouth conditions against the dental chart, it is the most accurate method. This accuracy, however, diminishes as the number of missing teeth increases, until absolute identification by such method becomes impossible in the edentulous mouth—or was impossible until the present time.

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A technic is described herein whereby acrylic resin dentures may be inscribed with the owner's name and other essential data. The materials necessary are included in ordinary office supplies. A sheet of lightest weight onionskin paper and any standard brand of carbon paper are required. The onionskin as the original, and with the carbon paper reversed as the second sheet, are inserted in the typewriter. The carbon paper is reversed so that the print will be transferred to the back of the original onionskin sheet, thus causing the type to appear in reverse. Suggested essential data consist of the patient's name, rank or rate, service number, ship or station, the mold and shade of the teeth used and the date of making the appliance. The onionskin is trimmed at the edge of the printing in short narrow



strips. The narrowness of the strips helps prevent any folding or wrinkling as the technic is carried out.

The case is prepared and packed with acrylic in the usual manner. Between the last trial closure and the final closing of the flasks the typed strips are dampened with water and are carefully placed on the soft acrylic with the typed side up. They should be arranged evenly just as desired in the finished case. The flask is closed carefully and the case processed. The pressure from closing transfers the carbon deposit from the onionskin into the soft acrylic, where it is cured. After recovery of the processed denture the paper strips may be gently scrubbed off and the inscribed identification remains.

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DIFFERENT USES FOR THE WALKING STIRRUP

EUGENE L. JEWETT
Lieutenant Commander (MC) U. S. N. R.

The novelty attached to the use of the walking stirrup for fractures and sprains about the ankle and foot is a thing of the past. However, there are several other uses for the stirrup which would warrant its more widespread disposition and use in our injured service cases. These walking irons come in several different lengths and have been made in the past few years mainly of duralumin. Recently, however, due to the metal shortage, they have been manufactured of steel. Both types of stirrups can be fairly easily bent, either over an object, or with the help of a wrench or pair of pliers.



1. Side view of walking stirrup cast for fractured ankle.

There are special bending irons which make the fashioning of these bars easier, but they are not necessary for this purpose. The various companies which make these stirrups provide extra rubber treads which can be easily applied to the bottom of the walking stirrup as the need for replacement occurs. The following photographs show the various stirrups with the walking treads attached, but generally when used for nonweight-bearing purposes the tread could easily be removed without affecting the function of the stirrup.

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There are many other uses for these stirrups besides the ones described in this paper. These include using the single arms of the stirrup as reinforcements for plaster of paris casts or for single traction splints for fractures of the bones of the fingers, hand, toes or foot, in the manner of the well-known Böhler type of finger splint. Such a splint generally is anchored in a plaster cuff extending up the forearm or up over the foot and ankle.

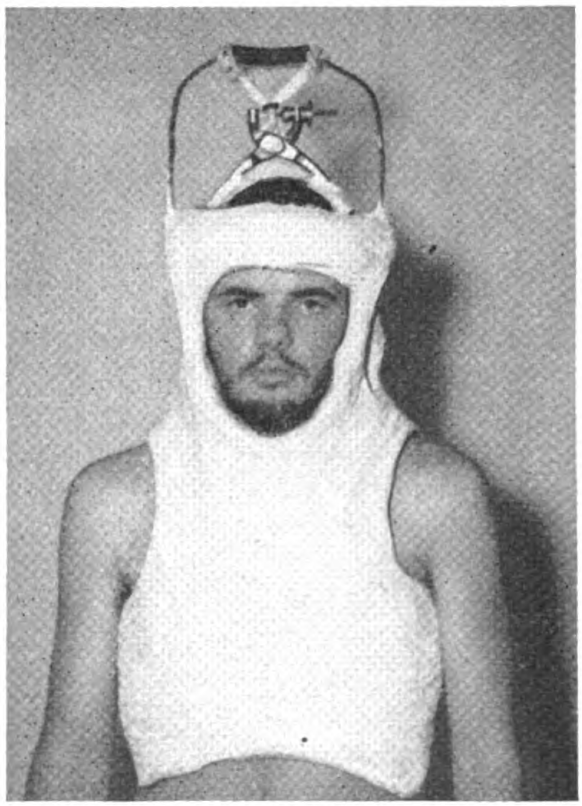
Another use of this stirrup which I have employed a few times is the Hoke type of suspension through the plaster hip spica cast, with skeletal or skin traction on the thigh. The stirrup is incorporated in the cast, which extends just above the knee joint with the closed end of the stirrup projecting down several inches below and around the knee. Then the traction is applied to and maintained by the end of the stirrup through either a supracondylar skeletal device, or adhesive along the thigh.

A similar device for fractures of the humerus or shoulder joint can be used with a shoulder spica, with the stirrup projecting out and around the elbow. Another place where a walking stirrup is very useful is in connecting up two parts of a plaster cast with a break between the two parts, to allow for wet dressings and inspection and treatment of massive wounds. Of course, this practice is not employed now as much as it used to be, but there are still certain cases where this bridged cast is indicated.

The patient portrayed in figure 2 had a fracture dislocation between the 6th and 7th cervical vertebrae, from a diving accident. Crutchfield tongs were applied, using local novocain anesthesia, and he was kept in bed with skeletal traction of about 8 to 10 pounds for 48 hours. At this time x-rays showed excellent realinement of the cervical spine and he was put up in a Calot type plaster jacket with the walking stirrup incorporated. He has been most comfortable in this outfit for about 6 weeks now, and is up and about the better part of each day.

One of the main advantages of this type of skeletal skull suspension over any other I have seen mentioned in the literature, is that the bars or stirrup from which the Crutchfield tongs are suspended run along the side of the head and neck and not in the back. This permits a snug-fitting, well-padded plaster cast to be molded to the occiput and rest of the head, and permits restful slumber on either side or on the back. Another advantage of this type of suspension is that it employs the use of a Calot jacket which only goes to the lower thoracic cage, while other type casts generally go down to the iliac crests.

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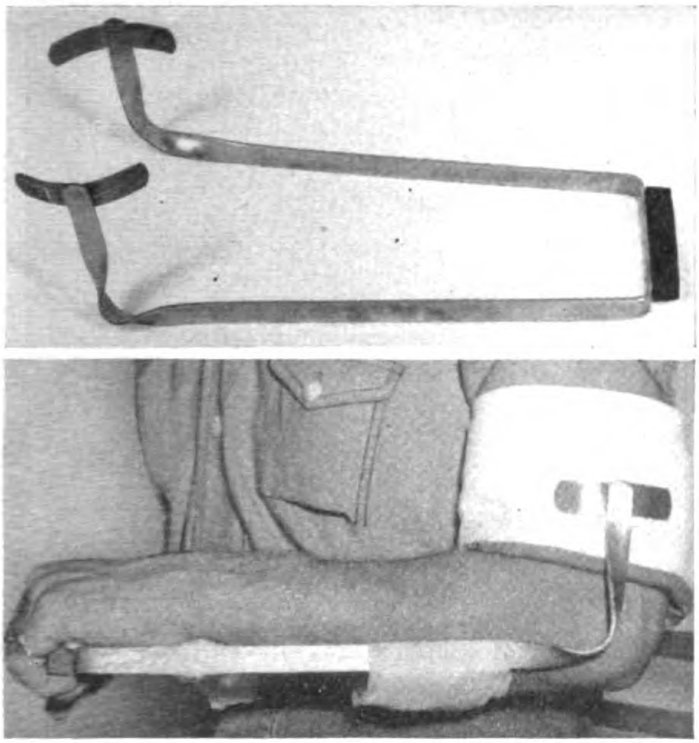


2. Front view of Crutchfield tongs skull traction with a walking iron incorporated in Calot plaster of paris cast.

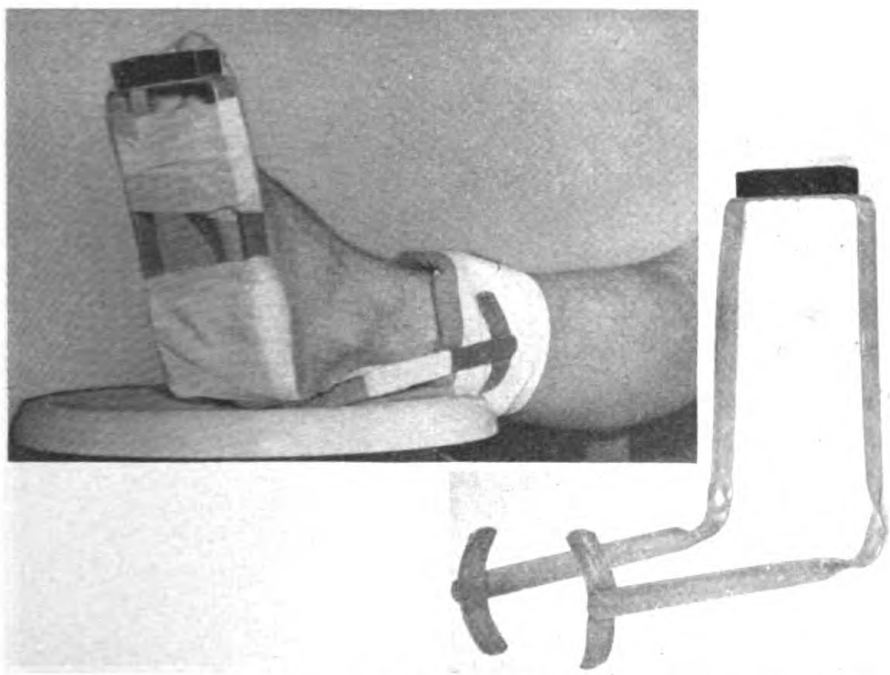


3. Walking iron bent in the form of, and to be used as a banjo splint. This would work by incorporating it in a plaster cast from the palm or wrist to the upper part of the forearm. The different places for anchoring the traction device to the splint can be made with a file, or holes drilled through the bar, or through the use of adhesive tape, which is perfectly adequate to prevent slipping.

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4 and 5. Walking stirrup bent to act for arm and elbow splint. This splint can easily be incorporated in a plaster cast from the elbow to the shoulder or held in place with bandages and sling.



6 and 7. Walking stirrup bent to hold the ankle almost at a right angle and to support the foot. This splint also is easily incorporated in a plaster of paris cast or can be used without plaster.

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Figures 4 and 5 depict the use of a short walking iron for fractures of the elbow—especially the supracondylar ones of the humerus. For several years now I have employed this method in fractures of this type and the results have been highly gratifying. Local novocain injection is almost always used, following which the well-padded plaster cuff is applied from axilla to a little above the elbow joint. Then the walking iron is incorporated with the side irons about 1 inch to 1½ inches anterior to the midline of the humerus, looking at the bone laterally This is done so that when the padded webbing or belt is applied to the posterior aspect of the elbow around the arms of the stirrup, there will be plenty of distance available for the desired pressure on the lower or elbow fragment. This arrangement allows for motion of the elbow joint, even with firm pressure applied to the lower, or distal fragments, posteriorly.

A TECHNIC FOR BUILDING HEAD CAST FRACTURE APPLIANCES FROM COAT HANGERS

WILBUR N. VAN ZILE
Commander (DC) U. S. N.

Many of the officers who will be called upon to treat fractures of the facial bones which result from traumatic injuries incident to the service, do not have head cast appliances. Without these to reduce and immobilize multiple fractures of the maxillae and facial bones, a very grave and complicated problem results. It is unlikely that mechanical aids will be available in the near future because of priorities. It was with this in mind that I undertook to construct a head cast appliance from coat hangers embodying the principles of some of the currently popular devices.

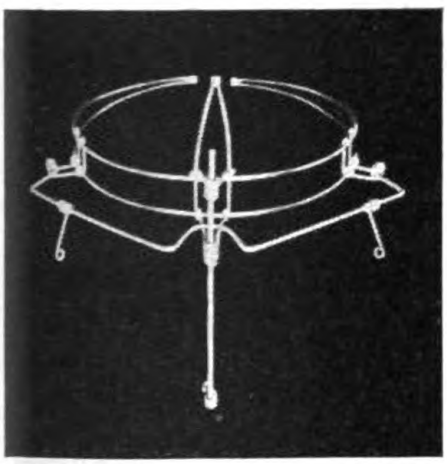
The coat-hanger type appliance is certainly not new; except for emergency treatment it has been falling into disfavor.

Lack of strength in many of the coat hanger appliances is due to the use of welding or brazing in the construction. The only temper possessed by a coat hanger is that which is imparted to the iron by drawing it through dies. If the wire is heated to a high temperature it becomes annealed and it is then too soft for proper strength. However, the technic described herein imparts strength equal to that of similar machine-made types.

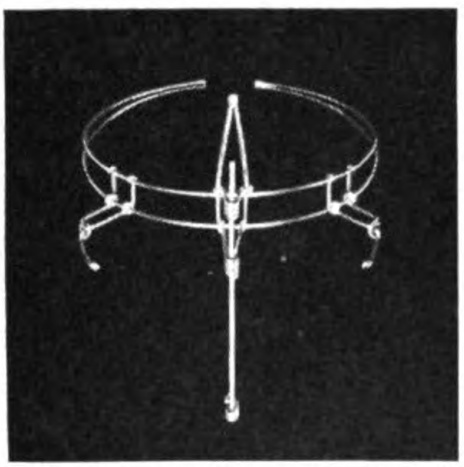
The appliances illustrated were constructed with a minimum of tools available almost everywhere in the Navy, namely a pair (or two) of common automobile pliers and a soldering iron. No other tools are necessary, but, if available, a metal file, a vise, and a pair of heavy wire cutters will facilitate construction.

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Figure 1 shows a coat-hanger version of the appliance described by Erich [2] in the treatment of fractures of the upper jaw. The principal feature of this appliance is an adjustable hook to which traction wires passing through the cheeks are attached. This hook is adjusted until there is no impingement of the traction wire upon the tissues through which it passes, thus preventing linear scarring. These same adjustments, with equal strength, are available in the appliance pictured. The set screws are replaced with soldered joints which have the advantage that the patient cannot manipulate the traction to alleviate temporary discomfort. No fear of burning the patient need be felt if the solder is carefully handled. The writer habitually holds the parts to be soldered in his fingers at a distance of about 1 to 1½ inches from the joint to be soldered. An assistant may squirt a jet of cold water from a syringe upon the wires where they are in contact



1. A head cast fracture appliance made from coat hangers.



2. Fracture appliance described in text.

with tissue. It is important to place a towel over the patient's face opposite the joint being soldered, in case some of the flux should spatter. Fundamental rules for soldering should be followed, namely, the use of a clean, freshly tinned soldering iron of adequate size, and care that the parts to be soldered are clean and in contact. Soft solder (lead) is used with rosin paste flux. Acid fluxes will not work well on iron.

The appliance shown in figure 2 is the one which will be described in detail. It is as equally adaptable as that shown in figure 1 and is not only easier to construct but is more rigid against the pull of the traction wires. It weighs only 4 ounces, yet possesses more than adequate strength when incorporated in a head cast.

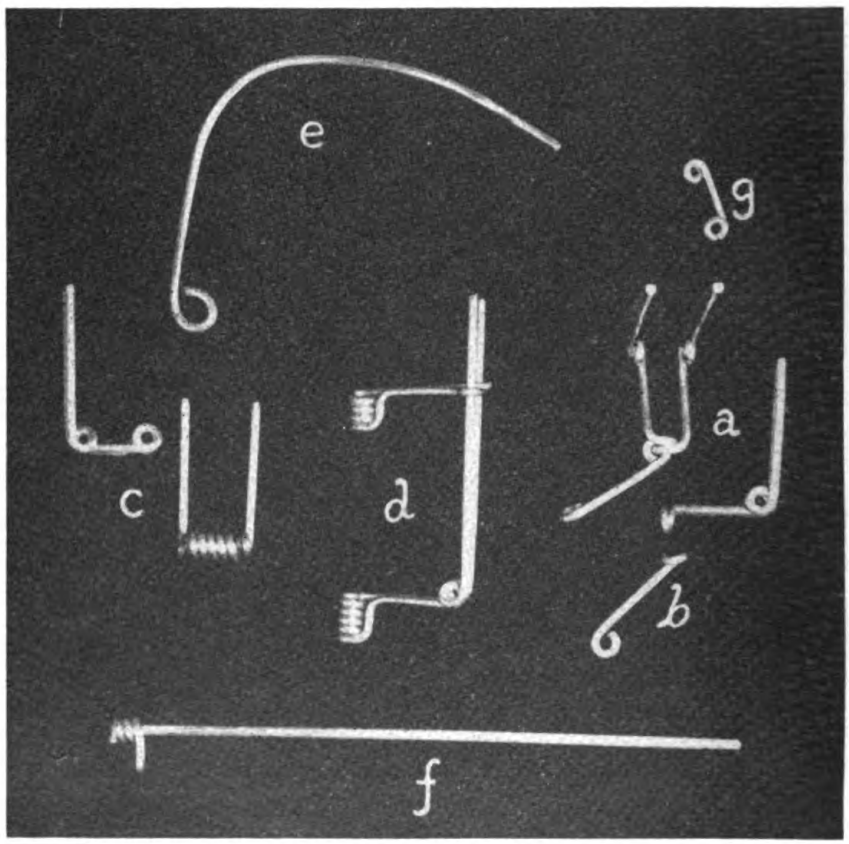
The coat hangers used in the construction of these appliances are

[2] Erich, J. B.: Treatment of fractures of upper jaw. J. Am. Dent. A. 29: 783–793, May 1942.

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(or were) readily available. The most common size is about 10-gage iron wire and this is used for the greater part of the appliance. However, certain parts require a heavier gage, such as the anterior and posterior traction rods. This material may also be found in the wardrobe closet, although the heavier hangers are not as common as the 10-gage. The heavier hangers are about 8-gage wire. Preferably, if available, a ⅛-inch steel rod should be used for the anterior traction rod. The material to be used for the various parts should be chosen before bending any of the wires.



3. Various parts before assembling. (*a*) Traction posts, (*b*) traction hooks, (*c*) posterior traction posts, (*d*) anterior traction post, (*e*) posterior traction rod, (*f*) anterior traction rod, (*g*) circular wire spacer.

The first step is to cut off the hooks and carefully straighten out the wire. The paint is then thoroughly removed with sandpaper. If the use of the wire is planned carefully, it will take 4 coat hangers and either a steel rod or 1 additional heavy-gage coat hanger for the anterior traction rod (fig. 3*f*).

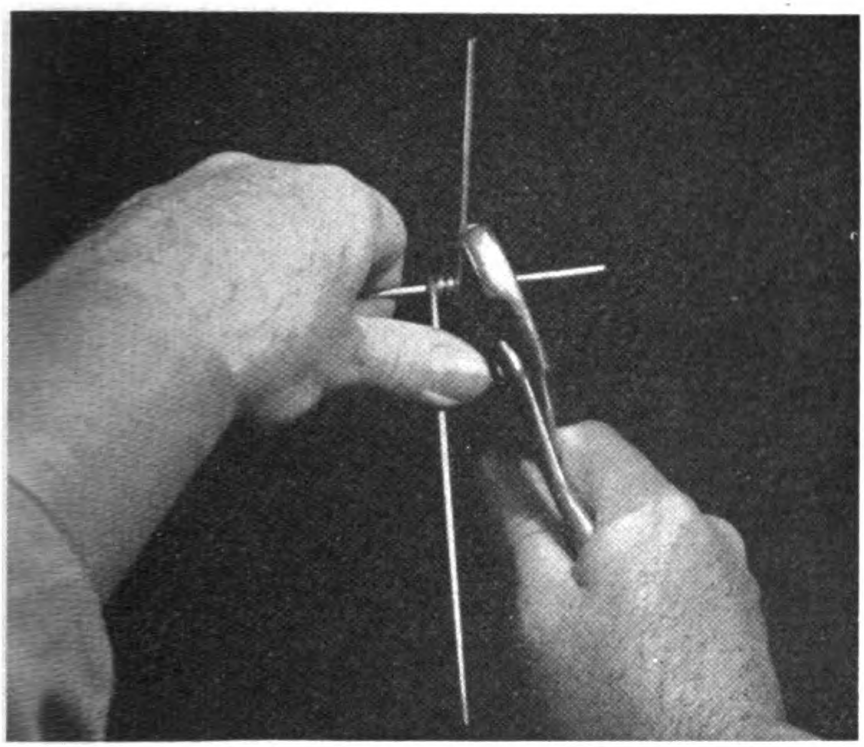
CONSTRUCTION OF PARTS.

The circular wires on which the various posts are mounted are made first. Two wires are bent into approximately an 8-inch circle. This is accomplished by wrapping the wire tightly about an object 5 inches in diameter (the writer uses a coffee jar; aboard ship a pipe

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would suffice). To bend the wire, one end is held tightly against the pipe, and the other is slowly bent to conform to the pipe, keeping the bending force at all times as close to the fulcrum as possible; otherwise a smooth curve will not be formed. This same principle is true wherever the wire is bent. An 8-inch circle is now drawn on a piece of paper and the two circular wires are, by hand pressure, made to conform with this circle. The ends, which now overlap, may be cut off.

The traction wire posts, to which the traction wires inserted through the cheeks are attached, are made next (fig. 3*a*). A length



4. Plier grasp for bending wire.

of wire about 10 inches long is required for each post. Mark the center of the wire, and using the plier-grasp shown in figure 4, bend 1 turn around the same size wire as will be used for the anterior traction rod. After the loop has been formed, remove the section about which the wire was bent. Grasp the eyelet in the beaks of the pliers and bend the wire on either side at a right angle to the eyelet, keeping the wires in the same plane and parallel to each other. Place a mark on each of these wires 1¼ inches in from the eyelet and, placing the beaks of the pliers on this mark, make a second right angle bend in the direction away from the eyelet, keeping both wires parallel. Now place a short section of the excess cut from the circular wires across the last bend and wrap 1½ turns around this wire so that a right angle is again formed. The second wire is bent

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similarly, keeping both wires in the same plane and parallel. Cut the wires off 1¼ inches from the loops thus formed. Two of these posts are required. Two hooks, 1½ inches long, are now made with eyelets at either end (fig. 3*b*). One eyelet is opened by bending sideways until it will slip through the eyelet on the traction post. It is then bent back, closing the loop. In making the hook eyelets, a smooth circular eyelet will result if 1½ turns are wrapped about a wire, the wire removed and the excess cut off at ¾ of a turn. The eyelets at either end of the hook should be at right angles to each other.

The posterior traction post (fig. 3*c*) is not required unless a fracture of the mandible, with displacement forward, has occurred distal to the last molar tooth. This post is made by wrapping 4½ turns around a piece of the material to be used for the posterior traction rod. Marks are placed on the wires ¾ of an inch from the coil thus formed. A loop is then formed in each wire as described in the preceding paragraph and the wires are cut off similarly.

The anterior traction post (fig 3*d*) is the most difficult part to construct because additional strength is required. Sixteen inches of wire will be needed for this part. Place a mark 5½ inches from the end of the wire and make a right angle bend. Across this bend place a section of the material to be used for the anterior traction rod. Grasp firmly with the pliers, as in figure 4, and wrap a coil of 4½ turns. If the bending force is kept close to the fulcrum and the turns are crowded closely together when wrapping these coils, a smooth compact coil will result. The two wires coming from the coil should now be parallel. Grasp the coil endways in the pliers and make a right angle bend in the longer wire toward the opposite end of the coil. Make a mark on this wire ⅛ inch in from the end of the coil. Slip the wire into the coil about which it was formed, grasp with the pliers on the mark just made and make another right angle bend in a direction which will bring the 2 wires into the same plane, keeping the wires parallel. Marks are now made on these 2 wires 1¼ inches from the center of the coil. Loops are formed as previously described for the other parts, making the first right angle bend in a direction away from the coil. The ends are cut off 3 inches from the loops.

If the force to be applied to the anterior traction rod is not heavy, the post described above will be adequate. However, if additional strength is needed, a second post is necessary (fig. 3*d*). Thirteen inches of wire is required for this post. Start the first bend 4 inches from one end. A coil is wrapped and bent as in the preceding paragraph. Marks are made on the wires 1⅛ inch from the center of the coil and the loops are formed in a plane at right angles to these same

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loops in all of the other posts. The wires are cut so as to form about three-quarters of a loop. The loops thus formed should be spaced so as to slide freely over the two wires of the main post.

ASSEMBLING THE APPLIANCES.

Mark the exact center of the two large circular wires. Slip the large anterior post on one of the wires, centering the post on the mark previously placed. These two parts are laid upon a flat surface with the coil hanging over the edge. Place a small amount of flux about each loop and tack lightly with solder. Allow to cool for a short time. Each joint is then soldered well, allowing sufficient time to cool, so that the first joint will not be melted when the second is soldered.

The traction wire posts are slipped similarly on either side and soldered to position. The distance from the hole in the anterior traction post to the center of the eyelet on the traction wire posts is approximately 4 inches.

If posterior traction is needed, these posts are soldered, in the same manner, opposite the condyle of the mandible.

The upper circular wire is now centered on the anterior traction post and tied to the wires of this post with 2 or 3 turns of fine wire. It is adjusted so that the distance between the 2 circular wires is about 1 inch. Each of these joints is soldered. Similarly, each of the other posts is first wired then soldered to the upper circular wire. Small vertical rods may be soldered between the 2 circular wires about 3 inches back of the traction posts to increase rigidity of the wires (fig. 3*g*). The ends of the circular wires are tied together with fine wire, and soldered as shown in figure 2. The appliance is now almost complete unless it is desirable to gain additional strength for anterior traction. In this event the upper part, which was described previously, is slipped over the 2 vertical wires of the attached post until the loops are in contact with the upper circular wire. The anterior traction rod is inserted through both coils to maintain the holes parallel while solder is flowed over the loop joints.

The last step is to bend the ends of the wires of the anterior traction post back following the curve of the forehead and, after tying together with fine wire, solder as shown in figure 2. This completes the appliance. With practice, the time required for construction will be about 3 hours.

ADJUSTING THE APPLIANCE.

The device is incorporated in a head cast in the following manner:

A few layers of plaster gauze are wrapped about the stockinet. The anterior traction rod (fig. 3*f*) is then slipped into the anterior

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post to aline the headband so that the anterior traction rod is centered on the nose and clears the nose by about 1½ inches. The flexible ends of the circular wires are pulled snugly about the cast and wired together at the back in this position. The traction rod is then removed and gauze or adhesive tape is wrapped about the wire posts in such a manner as to keep plaster out of the coils. Plaster gauze is then wrapped about the headband, thoroughly securing it. If the appliance is to be efficient, care should be taken to gain adequate retention of the head cast upon the head. Traction should not be placed upon the appliance until the plaster has thoroughly hardened.

The traction wires, when inserted through the cheeks, should be aimed in the direction of the traction wire posts. After the traction wires have been secured to the intra-oral splint or arch bar, thread the wire through the end of the traction wire hook. Flux the eyelet well with rosin paste. Protect the patient's face as described previously. The traction wire is drawn tight while holding the traction hook in the position in which there is no impingement of the traction wire upon the tissues through which it passes. Solder is then flowed into the eyelet by an assistant, securing the hook in this position. After both hooks have been soldered in this manner, loops are formed at the ends of the traction wires, leaving space to insert a strong rubber band between the end of the traction wires and the hooks. If there appears to be impingement upon the tissues when the rubber bands (or a small turnbuckle, if available) have been inserted, place the soldering iron upon the soldered eyelet until the solder softens, grasp the hook with a pair of pliers shifting it to a position which will eliminate the impingement. This procedure will be necessary several times during the treatment to compensate for slight shifting of the head cast. When the maxillary displacement has been reduced, the rubber bands are replaced with wire.

The anterior traction rod, if required, is slipped into the coils of the post to the proper position and tacked with solder onto the bottom of the lower coil.

The posterior traction rod, when necessary, is contoured, slipped into the coil of the post, and tacked with solder (fig. 5).

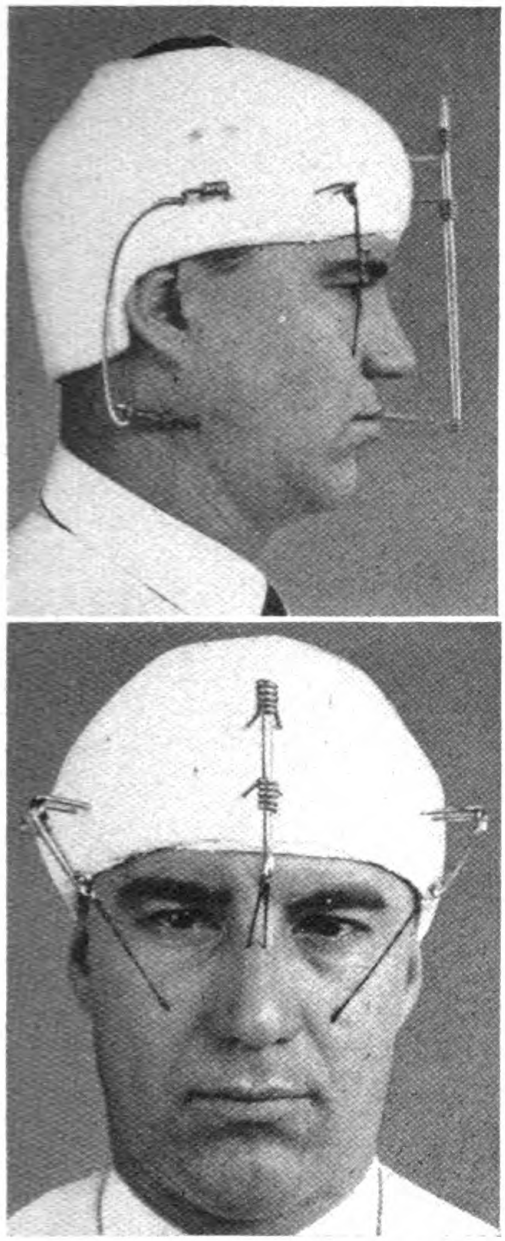
Nasal fractures, in which the bones have been depressed, may be elevated by means of traction wires attached to an intra-nasal acrylic rod or a coat hanger wire covered by a small catheter. The traction wires, after passing through the tissues of the nose, are attached to a hook inserted into the anterior traction post. The hook is adjusted vertically until the traction wires are at right angles to the bridge of the nose, then soldered in this position.

Acrylic or other types of chin slings may be attached by rubber traction to a hook inserted anteriorly into the posterior traction post.

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Figure 5 shows the manner of application of the appliance on a patient.

Coat hangers are made of iron and therefore precautions should be taken to prevent rusting. Immediately upon completion of construction the flux should be scrubbed free with a brush, soap, and warm



5. The appliance showing the various traction methods which are available.

water. Remove all water and wipe with gauze saturated in acetone. All surfaces are then coated with clear lacquer or cavity lining. This lacquer must be removed from the parts to be soldered by scrubbing with acetone when the appliance is put into use. If the appliance is to be used immediately, do not lacquer the areas to be soldered.

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AN IMPROVISED FLUOROSCOPIC SCREEN

T. McKEAN DOWNS
Commander (MC) U. S. N. R.
and
CARY H. HASKINS
Chief Pharmacist's Mate U. S. N.

Recently in the treatment of a fracture on board this vessel, the lack of a fluoroscopic unit was severely felt. We were able to improvise such a unit very simply. As it is believed that few medical officers are familiar with the method, we detail it here.

Each x-ray cassette contains two thin sheets of fluorescent material, which intensifies the shadows projected on them. It is simple to remove one of these screens and use it in fluoroscopy. The screens are thin and flexible.

We have used an old intensifying screen in this way with perfect satisfaction, and for certain situations feel it is even better than a regular fluoroscopic screen.

There is no reason why this method cannot be used where regular fluoroscopic units are not available. We must not forget that this method presents an insidious danger. The ordinary fluoroscopic screen is impregnated with lead salts, which stop the rays from penetrating the screen. The intensifying screen from the cassette does not have this property, so the operator is exposed to a much larger dose than in ordinary fluoroscopy. Therefore, every precaution must be observed meticulously and only experienced technicians should use this method.

The following technic and precautions are to be observed:

1. Use moderate current. Three to 4 M.A. will answer this fluoroscopic need, at about 60 K.V.P. This will give sufficient penetration for average extremities.
2. Three to 6 seconds of exposure followed by an equal period of rest should be the rule.
3. Keep the x-ray beam as *small as possible.* On portable units where one has no shutters, the field can be regulated with lead fittings.
4. Be sure that 1 mm. of aluminum filter is used. Most oil immersed tubes have ½ mm. aluminum incorporated; therefore ½ should be added.
5. If practicable use lead rubber aprons and lead rubber gloves.
6. The target-skin distance should never be less than 12 inches.
7. Do not allow exposures of any portion of the body to exceed 800 M. A. seconds.
8. It is imperative to bear in mind the total exposure limits of the patient and of the operator.

The above procedure can be duplicated with any portable x-ray machine without danger to the patient, operator, or machine if the eight rules, listed above, are observed.

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The improvised screen serves admirably in the reduction of fractures and dislocations. There seems to be no inherent reason why it cannot be used, with proper precautions, whenever fluoroscopy is indicated.

A SIMPLE HOMEMADE POWDER BLOWER

WAYNE S. HANSEN
Lieutenant (MC) U. S. N.

It is often better that a powder be applied to a lesion by blowing rather than by sprinkling, particularly when a fine sulfathiazole frosting is desired. Most small ships, especially destroyers, have not had commercial powder blowers included in their equipment and at present are unable to obtain them from supply depots. The ordinary hand atomizer may be used by taking out the glass standpipe and inverting the bowl as the bulb is squeezed, or by plugging the nozzle and turning the bowl on its side, allowing the powder to be blown out through the vent hole in the metal cap. Neither of these methods works very well, however, often squirting the powder rather than blowing it and frequently causing clogging of the blower.

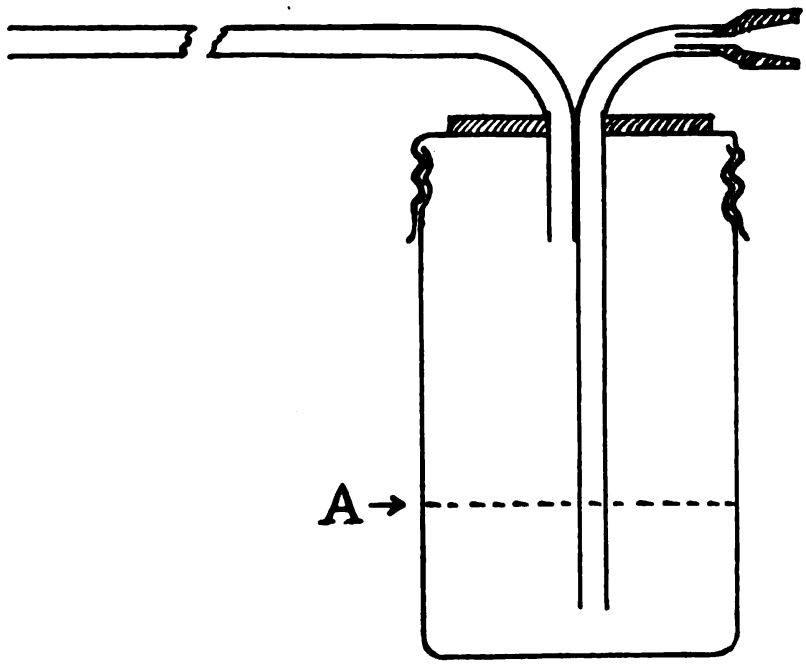
A very efficient blower may be easily made aboard any ship from materials on hand. On a destroyer one was made which has been in constant use for the past 9 months, giving excellent results. The materials used were:

1. A wide-mouth bottle about 1½ inches in diameter by 2½ inches high with a metal cap (an empty terpin hydrate bottle was used).
2. Two pieces of ⅛-inch brass tubing, 3½ and 6 inches long respectively.
3. A disk of 1/16-inch sheet copper about ¼ inch smaller in diameter than that of the metal cap.
4. One 16-gage hypodermic needle.

The disk of sheet copper was soldered onto the top of the metal cap to reinforce it, and 2 holes large enough to admit the brass tubing were bored close together through the center of the cap and disk. A right angle bend was then made about 1 inch from one end in each piece of brass tubing. The long end of the short piece and short end of the long piece were inserted through the holes in the cap and soldered in place. The free ends of the tubing were then in line, horizontal and pointing in opposite directions. The 16-gage needle was cut off about ¼ inch from the hub, this short end being inserted into the outside end of the short piece of tubing and soldered in place. The bevelled attachment on the ordinary liquid spray bulb fits part way into the needle hub. A gasket in the cap finishes the job. In use the bottle is filled about one-fourth full of powder.

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It was found that the long end of the short piece of tubing should be about 3/8 inch from the bottom of the bottle. A smaller nozzle may be made by soldering the remaining part of the needle into the



1. A sectional view of blower showing powder level (*A*).

exhaust end of the tubing. The essential feature in the construction of a powder blower of this type is to leave sufficient space between the level of powder in the bottle and the exhaust tube in the top to act as a mixing chamber.

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MORPHINE SUBSTITUTE

A new synthetic drug, 1-methyl 4-phenyl-piperidine 4-carboxylic acid ethyl ester hydrochloride (Demerol), has made its appearance as a substitute for morphine, especially if the supply of the latter should be threatened because of wartime conditions. It is one of a series of piperidine compounds, resembles atropine structurally, and possesses some of the properties of the latter, in addition to being a satisfactory analgesic and sedative. Demerol is said to be comparable to morphine and to be as reliable as the latter in the recommended dosage. The atropine-like properties of the drug are its ability to cause drying of the mucous membranes and its spasmolytic effect. Since it does not depress the cough reflex as does morphine and is effective for pain originating in serous membranes and smooth muscle, it may prove to be valuable in postoperative treatment. Whether its continued use will result in habituation has not been determined.—Zentgraf, L. P., and Eversole, U. H.: General anesthesia. New England J. Med. 229: 437–441, September 9, 1943.

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EDITORIALS

SYMBIONTS AND ANTIBIONTS

Sulfonamide fastness is traceable to the elaboration of *p*-amino-enzoic acid in the pathologic medium. The presence of such a sub-tance seriously impedes the effectiveness of the drug. Recently the stounding effects of gramicidin and penicillin have overshadowed he phenomenal therapeutic character of the sulfonamides. However, eports of penicillin resistance[1] already have appeared in the iterature.

Ever since Dubos[2] demonstrated the presence of a natural anti-acterial substance formed by the activity of a certain spore-bearing oil bacterium, Bacillus brevis, bacterial antagonism research has been eenly revived.

New antibiotic agents are being constantly added to the family of ntibacterials. The culture filtrates of such organisms as B. mycoides, nesentericus and subtilis are known to cause lysis of many species f micro-organisms. The antagonistic property of B. mesentericus iltrates for diphtheria organisms has been shown to be attributable o isovaleric and oleic acids produced during growth.[3] Micro-rganisms from the soil inhibiting the formation of the capsular naterial about the gram-negative Friedländer bacillus have been olated, as well as an alcohol soluble bactericidal toxin from bacterial trains found in cheese, manure and sewage.[4]

Most recently fumigacin from the mold Aspergillus fumigatus nd clavacin from Aspergillus clavatus have been reported[5] and give promise of paralleling penicillin in therapeutic importance.

Filtrate fractions of Penicillium notatum have brought to light penicillin B, penatin and notatin[6,7,8]. Whether these three are one

[1] Editorial. **Penicillin fast bacteria. J. A. M. A. 122: 748, July 10, 1943.**

[2] Dubos, R. J.: **Studies on bactericidal agent extracted from soil bacillus; preparation of agent. Its activity in vitro. J. Exper. Med. 70: 1–10, July 1939.**

[3] Hettche, H. O., and Weber, B.: **Die Ursache der bakteriziden Wirkung von Mesenteri-resultraten. Arch. f. Hyg. 123: 69–80, 1939.**

[4] Hotchkiss, R. D.: **Gramicidin, tyrocidine and tyrothricin. In press.**

[5] Editorial. **Antibacterial substances from Aspergillus molds. J. A. M. A. 122: 1252–1253, August 28, 1943.**

[6] Roberts, E. C., et al.: **Penicillin B, antibacterial substance from Penicillium notatum. J. Biol. Chem. 147: 47–58, January 1943.**

[7] Kocholaty, W.: **Cultural characteristics of Penicillium notatum in relation to production of antibacterial substance; indication of dual nature of antibacterial substance. J. Bact. 44: 469–477, October 1942.**

[8] Birkinshaw, J. H., and Raistrick, H.: **Notatin: An antibacterial glucose aerodehydrogenase, from Penicillium notatum Westling. J. Biol. Chem. 148: 459–460, May 1943.**

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and the same substance is open to speculation. All have one phase in common—insolubility in lipid solvents. They are tremendously effective against most gram-negative as well as gram-positive organisms and are different from true penicillin in chemical nature as likewise in mode of action.

The web of complex relationship binding living things is intricate, ultimately reducible to a pattern of an associative or antagonistic character. If continued existence is to be had, adaptation to either one or other environment is a necessity. The fundamental principles of bionomics are no less exacting among micro-organisms than among higher forms of life. Liability of extinction is the price demanded of every living thing for the privilege of living, and immunity is established only at the expense of some form of symbiosis, the problem each individual must solve or succumb.

Whether the antibiotic existence is an expression of a competition for or exhaustion of limited food supply, a space relation between antagonists and environment, the production of a definite inhibiting chemical or toxin injurious to the other is beside the point. The antagonized organism must develop a protective mechanism against the antagonist. In the economy of living things, organisms living in associations frequently develop characteristics which are foreign to them when living in pure cultures. Their metabolic and morphologic features may become modified to such an extent that they not only become capable of neutralizing the antagonistic agent but often can completely destroy it.

Thus the enzymic response of bacteria destroying penicillin and the neutralization of sulfonamide inhibition factor by the stimulation of *p*-aminobenzoic acid are examples illustrative of this fact. Sulfonamide fastness and penicillin fastness become intelligible in the light of symbiosis and antibiosis.

SLOW UNION OF FRACTURES

The incidence of fractures among battle casualties is high, extremity fractures prevailing. The impression [1] that fractures are taking longer to unite than formerly calls for a review of fractures, their management and complications.

Quality in functional recovery is the criterion of good end results; the time element in obtaining satisfactory functional union however is the variant involved in the healing of fractures.

Nonunion and delay in union cannot be confined to arbitrary time blocks. Nor is delay necessarily a forerunner of nonunion. Months

[1] Editorial. Slow union of fractures. Brit. M. J. 32: 669–670, May 29, 1943.

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may elapse in any given fracture before union ultimately results. Conversely a state of nonunion may exist relatively early (weeks) in the clinical course of fracture repair.

Irrespective of the comparative aspect as to whether fractures heal more slowly or more rapidly than formerly, figures such as reported elsewhere (p. 34) in this BULLETIN emphasize the frequency in which nonunion, malunion and delayed union complicate the incidence of fractures. Complications involving one-third of the fractures handled impose the obligation of more than just reviewing the methods of fracture management.

Factors responsible for delayed union have included interrupted immobilization, traction and distraction, infection, persistent angulation, too early weight bearing and loss of blood supply. Some[2] specifically incriminate skeletal traction as being responsible for the frequent occurrence of slow union.

With the many external fixation devices appearing on the market and their uncanny manipulation possibilities, distraction understandably may become the nemesis of the orthopedist.

Experiments with birds on the other hand illustrate the effectiveness of fragment irritation on healing by early weight bearing. It is difficult to see how slow union under these circumstances can occur unless distraction is present. Fixation without compensation for absorption of fragmented bony ends unwittingly creates a distraction frequently of magnitude.

Imperfect plaster immobilization under battle duress, particularly of compound fractures, is of less consequence than the savage sacrificing of bony continuity in the name of thorough debridement. Undoubtedly the surgeon's belief in miracles supersedes bony repair in these instances. Although the simple application of sterile surgical gauze with incorporation of the part in a cast strains the credulity of a surgeon trained in the modern surgical management of wounds, nevertheless in the light of present day statistical evidence there appears a basis in fact for the rationale of this treatment.

What part immobilization in unpadded plaster casts contributes to the mounting number of fracture complications is difficult to determine. The disadvantages are considered results of untrained application. Padding about bony prominences is ardently advocated even by the skilled operator and constitutes a point in keen clinical discernment.

The principle of fixed overtraction based upon counteracting muscle pull is a fallacy frequently frustrating reparative physiology. The

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[2] Burns, B. H., and Young, R. H.: Time of union in fractured tibia. Lancet 2: 299–301, September 12, 1942.

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insult to soft tissue complicating contusing war injuries is often great. Crushed traumatized muscles, tendons, nerves and blood vessels make repair slow and tedious. Fixation of fractured bones with metal appliances in these instances not only may be futile but disastrous.

Reposition without angulation, and adequate retention of fragments, are elemental orthopedic principles that give quality in restorative bony union—results not infrequently obtainable by time-tested simple manipulation and padded plaster immobilization.

ARSENIC IN ASTHMA

Elsewhere in this BULLETIN (p. 118) attention is directed to "Tropical Eosinophilia," a disease entity apparently endemic to the coastal provinces of India. Emerson's case, though not possessing all the findings pathognomonic of the disease as recorded by Weingarten,[1] nevertheless has sufficient clinical characteristics to permit a diagnosis of tropical eosinophilia.

Two facts however make the paper timely and important. First, the current India penetration will doubtless expose members of the armed forces to the disease, and information relative to its clinical features should awaken a realization of its possible presence. Its inclusion in the differential diagnosis of obscure asthmatic cases, particularly in men of the Far East fighting front, becomes mandatory.

Secondly, the seeming specificity of arsenicals in the control and eradication of the disease recalls the apparently discarded use of arsenic in chronic bronchial asthma.

In certain parts of this country arsenic with or without potassium iodide is used effectively as an adjunct in the bronchial type of asthma therapy. Its efficiency has been utilized sufficiently to warrant a more universal adoption. Whether its efficacy proceeds from the potent capillary dilatation action of the drug or its general systemic effect is not definite.

Respiratory embarrassment during attacks is lessened, thoracic constriction is relieved and the interval between paroxysms decidedly prolonged.

When given within therapeutic limitations the danger of arsenical intoxication is not immediate. The choice of drug and manner of administration reduce this hazard to a point where the advantages of therapeusis materially outweigh the toxicologic limitations imposed upon its use.

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[1] Weingarten, R. J.: Tropical eosinophilia. Lanset 1: 103–105, January 23, 1943.

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BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.

(For review)

BRUCELLOSIS IN MAN AND ANIMALS, by *I. Forest Huddleson, D. V. M., M. S., Ph. D., Research Professor in Bacteriology, Michigan State College;* contributing authors, *A. V. Hardy, M. S., M. D., Dr. P. H., Associate Professor of Epidemiology, DeLamar Institute of Public Health, Columbia University Medical School; J E. Debono, M. D., M. R. C. P., Professor of Pharmacology and Therapeutics, Royal University of Malta;* and *Ward Giltner, D. V. M., M. S., Dr. P. H., Dean of Veterinary Division and Professor of Bacteriology, Michigan State College.* Revised edition. 379 pages; 42 illustrations. The Commonwealth Fund, New York, publishers, 1943. Price $3.50.

The revised edition of this comprehensive book is almost identical with the previous edition published in 1939. Forty pages have been added, chiefly in the way of short paragraphs scattered here and there throughout the book. The bibliography contains 485 titles as compared with 378 in the previous edition. Unfortunately most of the added references refer to work prior to 1941; there are but 13 references to literature published in 1941 and but 2 references to articles published in 1942. Much valuable material which has accumulated in this period therefore has been ignored.

The index is devoted so almost exclusively to the listing of authors that it is extremely difficult to find references to subject matter. For example under D, E, J, K, W, and Z there is not a single reference to anything except the names of authors. Under many other letter headings there are but 1 or 2 clinical subjects buried in a mass of proper names. This poorly planned index makes it extremely difficult to find any of the valuable material so prodigiously scattered throughout the book.

Other workers in this field have properly refused to accept the significance of the opsonocytophagic test ascribed to it by Huddleson. Much credit is due him for the adaptation of the principles of the

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phagocytic index determination to the diagnosis of brucellosis but few will agree with him that "immunity" or "cure" can be estimated on the basis of the test, extremely valuable though it is when properly interpreted. The test simply indicates the degree of specific resistance of the patient's white cells to Brucella infection. A patient may die of Brucella infection, if sufficiently overwhelming, in the presence of marked phagocytosis in all the white cells.

The failure to separate and also to correlate the syndromes seen in acute and chronic brucellosis presents another glaring fault. Perhaps the most outstanding example of faulty clinical observations is the statement that patients must be observed for as long as 15 afebrile days in order to determine recovery. Brucellosis is a disease characterized by spontaneous remissions and relapses and is all too prone to recur even after temporarily successful therapy. All careful observers agree that patients must be observed over a period of months or years rather than days to determine recovery.

The senior author has devoted many years to the study of Brucella infection in man and animals and has made many valuable contributions to the literature. Hardy has had much experience in the epidemiology of brucellosis, especially of the acute illness. Debono's experience with Brucella infection on the Island of Malta has been great. Giltner has contributed much to the knowledge of the infection in animals and man. The combined knowledge and experience of the 4 authors make the compilation an essential part of the library of any student of this extremely important subject. It is to be hoped that a future revision will present the material in an accessible form so that the value of their work will be advanced. In its present form the book is of greater value to the laboratory and research worker than to the clinician.

Another handicap from which the book suffers is its division into 4 parts, each contributed by a well-known author in a limited field of brucellosis, none of which are correlated with the others. This results in much duplication of material as well as conflicting statements. Brucellosis in Malta which is well described under part 3 of chapter 4 by J. E. Debono could well be incorporated in the previous discussion of brucellosis in human beings. Except for its greater severity and the very high incidence of caprine brucellosis on Malta, the infection is not dissimilar to brucellosis in America where all 3 types of infection exist.

Considering the scope of the book there is too little critical comment on the various quotations from the literature. For example, on page 105, under the heading "Lymphatic System" there is the following statement: "Wise and Poston have succeeded in recovering Brucella from the infected lymph nodes of a great many cases of Hodgkin's

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disease. Most of the patients also had Brucella agglutinins in a diagnostic titer in their blood serums. They do not go so far as to claim that Brucella is the etiologic factor in Hodgkin's disease. If this were true one would expect to find a large number of cases of this disease on the island of Malta. The situation, however, is quite the contrary." This short comment made in dismissing this possibly important subject indicates but little thought on the part of the author. It is obvious that, if there is more than coincidence in the coexistence of Brucella in many cases of Hodgkin's disease, it would not necessarily follow that this must also prevail on the island of Malta. On Malta the melitensis (goat or caprine) strain of infection is found practically exclusively whereas in the Eastern United States the strain of infection is almost exclusively abortus (cow or bovine) strain. A special predilection for lymphoid tissue of various strains of Brucella, even of the same variety, might well exist. Different strains of Brucella in the two places make any comparison invalid unless it is known on other evidence that they are equally lymphotrophic.

TRAIL TO LIGHT, A Biography of Joseph Goldberger, by *Robert P. Parsons*. 353 pages. The Bobbs-Merrill Co., Indianapolis, Ind., publishers, 1943. Price $3.

The "log cabin boys" of America are the subjects of the interest, the dreams, and aspirations of countless thousands in the Old World. The career of Abraham Lincoln has brought many an immigrant to our shores and more than one has duplicated such success stories of the native born. In the biography of Joseph Goldberger, Dr. Parsons has now told the story of one of the greatest of these adopted citizens who began life in a poor Jewish home in Hungary. Brought to this country in childhood he grew up under the double handicap of alien birth and racial frictions. He had, however, a mind as bright as a diamond and soon forged rapidly ahead in the American schools.

The parents ran a little grocery store on New York's East Side and made a good living for themselves and their large family. The Jewish people have always revered scholarship and the boy was soon marked for one of the professions. It was hoped that he might even become a rabbi, for as it is the ambition of every Scottish Presbyterian mother to see a son "wag his pow in the pulpit," so it is the ambition of every Jewish mother to see a son the spiritual teacher of his people. The boy's inclinations, however, were toward scientific subjects. After two years in the study of engineering, he turned to medicine, graduating at twenty from the three years' course which was then the usual length of the curriculum in our medical schools.

A realization probably of his own abilities and genius for research led him early into the United States Public Health Service where his powers were soon recognized. For the rest of his life he was

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to be one of the trouble-shooters sent by the Service wherever epidemics killed and terrified. He solved many of the problems dealing with the spread and prevention of typhoid, dengue, yellow fever, and typhus, but it was probably the light he threw on the cause and prevention of pellagra that will give him permanent fame among the great pioneers of medicine. His work with pellagra is one of the milestones of medical progress and the experiment by which he demonstrated the non-infectious character of pellagra deserves a place beside the classic experiments of Lind with scurvy, and Walter Reed with yellow fever. Dr. Parsons has given the chapter in which he describes this experiment the dramatic title of "Fifteen Men and a Housewife." The latter was Mrs. Goldberger who thus became the heroine of this research.

Through her interest in having her famous husband's career recorded, Dr. Parsons had access to unusually valuable material in the preparation of this biography. An old sea chest full of letters to his wife and professional associates, notebooks, scrapbooks, pictures and similar matter were made available to him. Mrs. Goldberger and the children supplied many recollections and reminiscences through interviews. Dr. Parsons himself had met Dr. Goldberger and his description of the meeting and his impressions of the man and his work forms an interesting feature of the preface.

The book is attractively bound and printed. It should be a strong candidate for the Pulitzer Prize for the best American biography of 1943.

DOCTORS AWEIGH, The Story of the United States Navy Medical Corps In Action, by *Rear Admiral Charles M. Oman*, (MC), USN. 231 pages; illustrated. Doubleday, Doran & Co., Inc., Garden City, N. Y., publishers, 1943. Price $2.50.

Admiral Oman is one of the Navy's most distinguished surgeons, is a highly successful administrator, and a fluent public speaker. This should be enough of achievement and talent for one man, but in addition he has become an author and now has produced a book which should be popular with many classes of readers, particularly at this time.

The book starts out with a bang both literally and figuratively, for the first chapter describes in graphic terms the attack on Pearl Harbor from the standpoint of the personnel of the naval hospital there. It contradicts the jibe of the man in the street that the Navy was "fully unprepared." Certainly the Medical Department was ready that Sunday morning and stood up manfully under the tremendous burden of suddenly having to care for the casualties from the fleet.

The Medical Department of the Navy, the doctors, the dentists,

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the nurses, the hospital corpsmen, their history, their work, their troubles, and their triumphs and failures are the subject of Admiral Oman's book. Reading it one comes to feel that even the failures are a noble kind of triumph, for each has a story of a fight against disease and death waged gallantly and unremittingly. Among many fine parts of the book is the chapter on the hospital corpsmen, and one entitled "Wardroom and Forecastle." This latter should be required reading for the indoctrination course of any medical officer.

Though it is a serious narrative it is full of humor. A sailor for 40 years, the Admiral has a fund of good stories and anecdotes which are sprinkled liberally through the book, and which illustrate the life in the Navy and the experience of a medical officer in it better than long descriptions and discussions. Some of the humor is broad and some of it very subtle. There is one story on page 53 alone worth the price of the book.

The book is bound in navy blue with the gold oak leaf and acorn of the Medical Corps of the Navy on the front cover. There is an artistic book jacket too, with the picture of a hospital ship on the front, and on the back page a fine photograph of Admiral Oman seated at his desk with the wall behind him covered with pictures of the ships on which he has served.

A MANUAL OF CARDIOLOGY, by *Thomas J. Dry, M. A., M. B., Ch. B., M. S. in Medicine, Assistant Professor of Medicine, University of Minnesota (Mayo Foundation); Consultant in Section on Cardiology, Mayo Clinic.* 310 pages with 80 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1943. Price $3.

This book is a handsomely bound, flexible covered, pocket size treatise, which, to this reviewer, is one of the most outstanding books of its kind produced on cardiology in the last 15 years. In its simple, short but thorough, abundantly illustrated, and exquisitely narrative way, it makes easy, quick, and delightful reading for pupil, physician, and teacher, who, especially, can profit maximally from its style of presentation, which is entirely original and not at all "textbooky." It is outstandingly up-to-the-minute in its concepts of cardiac diseases, pathologic physiology and anatomy, and therapy. The text includes all fields of cardiology, and the illustrations include those of anatomy, pathology, physiology, electrocardiography, electrostethography, and roentgenology. This book sells to doubting Thomases the concept of "ventricular strain" with its electrocardiographic manifestations. It also shows electrical alternans, the electrocardiographic counterpart of pulsus alternans, which is the first this reviewer recalls having ever seen in any textbook. A very descriptive table of contents and a 21 page index enable this book of knowledge to be quickly and readily transformed into a manual of cardiology.

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Due to the author's ingenuity in making the study of cardiology and its problems appear simple this book is destined to serve seekers of knowledge in cardiology more beneficially and influentially than most texts that they may have ever read. It merits unqualified recommendation.

CLINICAL ROENTGENOLOGY OF THE CARDIVASCULAR SYSTEM, by *Hugo Roesler, M. D., F. A. C. P., Associate Professor of Roentgenology and Cardiologist, Department of Medicine, Temple University School of Medicine.* Second edition. 480 pages with 337 figures. Charles C. Thomas, Springfield, Ill., publishers, 1943. Price $7.50.

This is a very comprehensive and carefully written text on clinical roentgenology of the cardiovascular system. The alterations in anatomy and circulatory dynamics are carefully detailed and supplemented by well-reproduced photographs. To the experienced radiologist the detailed descriptions will suffice but to the beginner the inclusion of more outline drawings of the described changes would enhance the value of the book.

Technic standards are sufficiently stressed to permit accuracy in comparison between radiographs taken at various stages of the disease. It is to be regretted that the orthodiascopic method was not employed more, in view of its ease of application.

The chapter on peripheral vascular disease is very well written and forms a valuable addition to the book. A large bibliography supplements the book.

The book represents a worthwhile reference in the library of both radiologist and cardiologist.

A MANUAL OF CLINICAL THERAPEUTICS, A Guide for Students and Practitioners, by *Windsor C. Cutting, M. D., Associate Professor of Therapeutics, Stanford University School of Medicine, San Francisco, Calif.* 609 pages. W. B. Saunders Co., Philadelphia, Pa., publishers, 1943. Price $4.

This book, as its title implies, primarily is devoted to medical treatment, with a brief description of the diseases or conditions to be treated and their etiology. General measures are first discussed and later, in most instances, the handling of complications. For such a small volume the subject is dealt with comprehensively and most of the orthodox measures available at the present time for prevention and treatment are mentioned. They are of course not discussed in detail.

In addition some space is devoted to dietary measures and diets, general nursing care and in several appendices are included tables of weights, measures, data as related to common clinical examinations, and certain quantitative methods for controlling the dosage of drugs. The arrangement of its contents is satisfactory and the printing clear; unfortunately there are no illustrations.

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It should prove of value to interns, medical students, and nurses; it might also be used as a reference book for hospital corpmen.

YOUR ARTHRITIS: What You Can Do About It. by *Alfred E. Phelps, M. D.;* with an introduction by *R. Garfield Snyder, M. D.;* illustrations by *James Macdonald.* 192 pages; illustrated. William Morrow & Co., New York, publishers, 1943. Price $2.

In arthritis, as in diabetes and allergy, the enlistment of the patient's cooperation and understanding is all important if any benefit is to be achieved. If, as a matter of routine, the doctor would see that each arthritic under his care were supplied with a copy of this little book, he could be assured of a higher index of cooperation and understanding.

While this is primarily a manual for the patient, written in simple and readable style, it is sufficiently authoritative to be read with profit by the physician himself.

The field of specific and nonspecific arthritis is well covered, and the illustrations well prepared. The type is large, the paper glare-free, and the volume sufficiently light in weight for easy bed reading.

The chapter on diet in arthritis includes an excellent chart of the purine content of foods (for the gouty patient), and merits extra mention for its clarity and practical approach.

The tone of the book, which is rather over optimistic, is probably justified when one considers the necessity for neutralization of the defeatist attitude toward arthritis so prevalent among the laity.

NUTRITION AND DIET IN HEALTH AND DISEASE, by *James S. McLester, M. D., Professor of Medicine, University of Alabama, Birmingham, Ala.* Fourth edition, thoroughly revised. 849 pages. W. B. Saunders Co., Philadelphia, Pa., publishers, 1943. Price $8.

This book makes a distinctly favorable impression on the reviewer because of its completeness as a reference work. The dietary treatment of so many conditions encountered in medical practice is set forth in elaborate detail right down to daily menus. It is one thing to prescribe a low residue diet for diarrheas or a smooth diet for irritable colon, but it is quite another thing to elucidate the qualitative and quantitative features of these diets. In this book the author has ably done this. He has presented the physiologic treatment of the essential food stuffs by the digestive tract and incorporated these facts into the rationale of his dietary regimens. Probably the outstanding features of the book are the two sections on vitamins, one on the vitamins from the point of view of chemistry, requirements, methods of assay and utilization by the body, and the other on related deficiency states. In these sections there is summarized all the recent work on these important elements of the diet, and I have seen no other work so completely covering the literature of this field. As a

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reference book for information in the field of vitamins this book would be well worth having.

Other sections of the book cover diet in diabetes mellitus, gout, obesity, leanness, allergy, kidney disease, cardiovascular disease, gastro-intestinal tract disease, only to mention the most important. Their treatment follows the well-established, orthodox principles so well popularized by well known clinicians and sustained through years of experience. I am particularly glad to see that Dr. McLester so frequently throughout his book emphasizes treatment of the patient as a whole and not just the local or dietary treatment of the symptom complex; for, as is well known, particularly in gastro-intestinal disorders where dietary treatment must necessarily be important, the underlying cause may be of emotional or psychogenic origin and no matter how fine the dietary treatment may be the patient will not get better until the emotional conflict is solved or other disturbing influences removed.

In conclusion, this book is well balanced and the place of diet in the treatment of disease is given its proper place along with other methods. I believe more emphasis should be placed on the preparation of foods in special diets to increase the satiety value. Patients get tired of pureed diets and it is up to the doctor to help make these diets interesting, palatable, and varied.

PAIN MECHANISMS, A Physiologic Interpretation of Causalgia and Its Related States, by *W. K. Livingston, Lieutenant Commander, (MC), USNR.* 253 pages. The Macmillan Co., New York, 1943. Price $3.75.

This book is a timely, valuable, and obviously practical treatise on the mechanisms involved in the production and alleviation of pain. Its value will increase as the number of combat injuries to peripheral nerves mount. The author approaches the mechanisms of pain from a historical, anatomical, neurophysiological, and psychological aspect.

The section on the anatomical factors is brief but adequate, while that on the neurophysiological factors is exceptionally clear, concise, and condensed. The section on the psychology of pain summarizes much of the controversial opinions on this point and in addition the author advances a tentative hypothesis of his own to explain the "integrative" action of the central nervous system on centripetal impulses. Pain is discussed not as an isolated unpleasant perception, but as a factor which influences the entire psyche and soma.

In discussing the causalgic pain states (causalgia, post-traumatic pain syndrome, neuralgia, hyperalgesia, phantom limb pain, and some cases of chronic low back pain), the author says that there are three reciprocating factors in the "vicious circle of the causalgic state." He describes these as "incoming impulses from the periphery, the internuncial pool activity, and the motor impulses from the anterior and lateral horn cells that are brought within the influence of the

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pool." He advances much neurophysiological evidence and offers abundant clinical data in support of this thesis. The author emphasizes the value of infiltration of "trigger areas" and injection of the ganglionic chain by a temporary anesthetic (novocain) in treating these cases which many times give surprisingly prolonged and even permanent relief.

This book is compact; the print is distinct and easily read; and it is adequately illustrated by line drawings and plates. There is a concise summary, an unusually extensive bibliography and the volume is well indexed.

CONVULSIVE SEIZURES, How To Deal With Them, A Manual for Patients, Their Families, and Friends, by *Tracy J. Putnam, M. D., Professor of Neurology and Neurosurgery, College of Physicians and Surgeons, Columbia University.* 168 pages; 12 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1943. Price $2.

Dr. Putnam's book, while not intended primarily for physicians, will be of aid to the busy practitioner by providing him with an abbreviated manual on the epilepsies. It is a work that can be highly recommended to the patient and his family. The distress which ignorance adds to the already great burden carried by those suffering from convulsive disorders has long awaited the relief which is bound to follow such common-sense presentations.

In 159 pages, Professor Putnam reviews in simple, nontechnical language the cause, diagnosis, and principles of treatment; he suggests what the patient and bystanders can do to help, the outlook, both for the individual and for the control of the disorder, and ends with a unique and much needed feature—"For lawyers and legislators only." The use of lists of concise rules, regulations, and statements tersely highlights each chapter. The few simple line illustrations are clear and pertinent.

Dr. Putnam routs the bête noire of all authors who attempt to present medical subjects to the laity by frankly documenting the facts; in doing so he successfully overcomes the physician's natural trepidation in suggesting correlative reading by subtitling his chapter "About Medical Writings On The Subject": "Perhaps The Less Read The Better."

"Convulsive Seizures—How To Deal With Them" is enthusiastically recommended.

DISCOVERING OURSELVES, A View of the Human Mind and How it Works, by *Edward A. Strecker, A. M., M. D.*, and *Kenneth E. Appel, Ph. D., M. D.*, in collaboration with *John W. Appel, M. D.* Second edition. 434 pages. The Macmillan Co., New York, publishers, 1943. Price $3.

This is a revised second edition of a volume on popular psychology, first published in 1931. The addition of three new chapters on emotion, anger, and fear to the new edition is a dubious virtue, for one

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wonders how much more the average reader will derive from these than he already has from the rest of the book.

The seemingly endless writing of popular psychological books naturally suggests the question of their worth-whileness. They are addressed, of course, not to the medical profession but to the average lay reader, in language that must make the most intelligent feel that he is being patronized. The danger of oversimplification is hard to avoid in any book for popular consumption, and it is frequently easy in a field as complex as human psychology. Nor can it be said that the authors of this volume have done so.

The main value of a book of this type is to help the lay public recognize the existence of human ills and troubles which have no physical basis but inhere in the defects, weaknesses, and clashes of personality organization. This concept is slow to seep into public consciousness and it is hoped this book will serve to that end. It is not designed for and not recommended to physicians.

CLINICAL SIGNIFICANCE OF THE BLOOD IN TUBERCULOSIS, by *Gulli Lindh Muller, M. D., Pathologist and Director of Laboratory, New England Hospital for Women and Children, Boston.* 516 pages. The Commonwealth Fund, New York, publishers, 1943. Price $3.50.

This book is a significant and epochal contribution in the field of pulmonary tuberculosis. The author has recognized and shown the effect of tuberculous disease on hemapoietic activity. The data presented is most formidable evidence based on a detailed study of 6,819 complete blood examinations of 1,000 cases of pulmonary tuberculosis. The study includes interpretation of significant changes in the leukocytic formula, red cells, hemoglobin, and sedimentation rates in minimal, moderately advanced and far advanced pulmonary tuberculosis.

The ensuing qualitative and quantitative changes in the circulating blood which occur in tuberculosis serve as a barometer of tuberculous activity. Its importance as such an indicator in subclinical pulmonary tuberculosis cannot be overemphasized.

Dr. Muller has presented in a most illuminating manner the value of such hematological studies as an adjunct to the diagnosis, prognosis, and selective collapse therapy of pulmonary tuberculosis. Cytological studies likewise assist in evaluating the effectiveness of various types of collapse therapy, when pulmonary collapse limits the reliability of physical examination or roentgenological studies.

This book should prove of immense value and interest to the hematologist, clinician, and thoracic surgeon.

CLINICAL LABORATORY DIAGNOSIS, by *Samuel A. Levinson, M. S., M. D., Director of Laboratories and Pathologist, Research and Educational Hospitals, Chicago, Ill.;* and *Robert P. MacFate, Ch. E., M. S., PhD., Assistant Director of Laboratories, Research and Educational Hospitals, Chicago, Ill.* Second edition,

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thoroughly revised. 980 pages with 156 engravings and 15 plates. Lea & Febiger, Philadelphia, Pa., publishers, 1943. Price $10.

This is the second edition, completely revised and brought up to date, of this excellent book on clinical laboratory diagnosis. The material is presented clearly and concisely and irrelevant and superfluous matter is excluded. The normal findings are presented, then compared with the abnormal along with clinical symptoms and pathology and where deemed necessary a brief review of anatomy, physiology, and biochemistry is given to enable the reader to correlate these findings.

The two chapters entitled "Laboratory Methods in Pediatric Procedures" and "Legal Medicine and Toxicology" are of special value and give information difficult to obtain in any other book.

All of the latest valuable and important laboratory methods and items are included in this edition, some of which are sulfanilamide and its derivatives, prothrombin, thiocyanates, ascorbic acid, phosphatase, amylase, Rh factor, and Weltmann's reaction.

Numerous excellent and valuable illustrations and tables are also presented which add to the completeness of the book.

METHODS FOR DIAGNOSTIC BACTERIOLOGY, A Complete Guide for the Isolation and Identification of Pathogenic Bacteria for Medical Bacteriology Laboratories, by *Isabelle G. Schaub, A. B., Instructor in Bacteriology, Department of Pathology and Bacteriology, The Johns Hopkins University School of Medicine;* and *M. Kathleen Foley, A. B., Bacteriologist in Charge of the Diagnostic Bacteriological Laboratory of the Medical Clinic, The Johns Hopkins Hospital, Baltimore, Md.* Second edition. 430 pages. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $3.50.

This book fills a real need created by the growing demand for rapid and accurate diagnostic bacteriological work. Its viewpoint is essentially practical and it makes no pretense of supplying a theoretical background or of developing an understanding of the basic principles which underlie the science of bacteriology.

The authors have selected those methods which their own experience has proven to yield best results in the handling of blood cultures, throat cultures, urine cultures, etc. The directions given are so explicit that anyone who has mastered the basic fundamentals of bacteriological technic can follow them without difficulty and can obtain dependable results thereby. Many little tricks of the trade are included to good advantage and should go far to simplify the problems of the laboratory technician.

The subject matter is logically divided into three parts: Bacteriological diagnosis; serological diagnosis; and media, stains and staining technics, reagents, and tests. A very useful addition to the second edition is a chapter on the identification of pathogenic bacteria by colony characteristics. If the methods outlined are followed the laboratory worker will be able to place in the hands of the clinician

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an accurate report usually within 24 hours after receipt of the specimen. The subject matter is printed on the odd-numbered pages and the even-numbered pages are left blank for notes.

The wide experience of the authors, the careful selection of methods, and the sensible organization of the material included combine to make this an excellent volume for the practical bacteriologist.

TEXT BOOK OF INORGANIC PHARMACEUTICAL CHEMISTRY, by *Charles H. Rogers, Sc. D., Dean of the College of Pharmacy and Professor of Pharmaceutical Chemistry, University of Minnesota.* Third edition, thoroughly revised. 704 pages; illustrated with 52 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1943. Price $7.50.

This third edition, according to its preface, was required to meet the many changes in the official monographs on inorganic compounds recognized by the twelfth revision of the United States Pharmacopoeia and the seventh edition of the National Formulary.

Page for page comparison with the last edition, however, fails to reveal any drastic resetting, modification, or correction which the preface of the Third Edition had led one to expect. From this point of view the book is a disappointment. There are changes which perhaps bring the volume up to an ideal standard but the reviewer doubts whether these changes were of sufficient importance to require a re-editing in these days of drastic paper shortages.

Doubtless the restricted character of the book meets a special need and certainly should prove a helpful aid for elementary students of pharmacy. Its clear, easy style makes a readable volume. The arrangement in a manner as to fulfill the needs of a laboratory guide as well as a didactic text materially enhances the work.

These, however, are all qualities of the second edition.

Ionic equations make known to the student the basic character of the reacting substances and certainly should always be found in a work on inorganic chemistry. Such addition assuredly improves the volume from the chemist viewpoint.

Technically the book is a beautifully bound one, is of high quality stock and excellent printing and should be a source of pride to its publishers.

URINE AND URINALYSIS, by *Louis Gershenfeld, B. Sc., P. D., Ph. M., D. Sc., Professor of Bacteriology and Hygiene and Director of the Bacteriological and Clinical Chemistry Laboratories at the Philadelphia College of Pharmacy and Science.* Second edition, thoroughly revised. 304 pages; illustrated with 42 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1943. Price $3.25.

Professor Gershenfeld has brought together in a small compact volume the essential information obtained from a study of the urine in disease. The first hundred pages are devoted to the interpretation of findings and the remaining 200 are concerned with methods. His

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manner of presentation is clear, elastic, and individual. It is based upon the personal performance of over 40,000 urinalyses.

The section on urine sediment shall prove of much value to student and practitioner because of the abundant illustrations of the various casts, crystals, and extraneous matter. There is an unusually elaborate chart to show the methods of differentiating the various reducing substances present in urine. It is the reviewer's belief that more space could have been devoted to the renal function tests.

The book's value is enhanced by adding a third part which includes urinary calculi and their analysis, infrequently performed urinary tests which includes the detection of inorganic metallic poisons in urine, bacteriologic examination, and the diagnosis of early pregnancy.

There are such few errors, it is scarcely worth while mentioning them.

In summary, it may be said that this publication should be a ready reference to all physicians, students, and technicians who carry out urinalyses.

UROLOGY IN GENERAL PRACTICE, by *Nelse F. Ockerblad, B. S., M. D., F. A. C. S., Professor of Clinical Urology, University of Kansas School of Medicine;* and *Hjalmar E. Carlson, B. S., A. M., M. D., F. A. C. S., Instructor in Urology, University of Kansas School of Medicine.* 383 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1943. Price $4.

Although written primarily for medical students and general practitioners, the urologist of wide experience will find much delight in reading this charming little volume of 383 pages. He will particularly enjoy reading between the lines. Though didactic in style for the sake of brevity, the reader finds enough mental latitude to interpolate his own ideas which are the result of his own personal experience.

Each of the 21 chapters is short and each one is complete in itself. It is quite remarkable that such a complete digest of urologic fundamentals could be presented and yet much pertinent material be omitted. The authors have been as diligent with the scissors as with the pen. The many illustrations, both schematic and photographic, enhance materially the value of the text. An excellent index makes ready reference possible.

ESSENTIALS OF SYPHILOLOGY, by *Rudolph H. Kampmeier, A. B., M. D., Associate Professor of Medicine, Vanderbilt University School of Medicine; in Charge of the Syphilis Clinic and Visiting Physician to Vanderbilt University Hospital;* with chapters by *Alvin E. Keller, M. D.* and *J. Cyril Peterson, M. D.* 518 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1943. Price $5.

As the title of this book would indicate, only the essentials of syphilology are presented. It was written primarily for the general practitioner of medicine to give him a brief but comprehensive presentation of the study of syphilis and for this purpose it is an excellent book.

It is a timely piece of work inasmuch as the diagnosis and treatment

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of syphilis at this time are going through a state of mutation, especially in regards to the interpretation of blood serological tests, and massive-dosage treatment, multiple injection schemes and combined fever and massive-dosage. As the author states, however, "Some years must elapse before the results of such trials can be evaluated and therefore these methods should not be undertaken by the average physician."

The subject is adequately presented, the style is clear, concise, and easy to read.

The book is small and nicely bound which facilitates handling.

ENDOSCOPIC PROSTATIC SURGERY, by *Roger W. Barnes, M. S., M. D., F. A. C. S., Professor of Clinical Urology, College of Medical Evangelists.* 232 pages with 104 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $6.

Dr. Barnes has written this monograph expressly for the urologist interested in endoscopic surgery and for the residents and house officers who will be exposed to this type of surgery in their training. It is well written and easily understood even in its more technical parts. The methods described, as the author points out, are his own and may not be either universal or the best, although they have proven very satisfactory in his hands.

The first third of the book is taken up with a discussion of the anatomy and pathology of the prostate and examination of the patient and would be excellent reading for any young doctor. The greater part of the book is devoted to a detailed account of the technic of the titled subject and includes a chapter on punch prostatectomy. There are also discussions on pre- and post-operative care of the patient and complications of transurethral surgery which are of general interest to internes or men who have occasional contact with urological patients. The author has done well in presenting a limited subject, and those in the field of urology will find his book most interesting.

The illustrations are well done and fully explained. The volume is sturdily bound and printed on good quality paper.

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PREVENTIVE MEDICINE

Commander T. J. Carter, Medical Corps, United States Navy, in Charge

TOXIC EFFECTS OF ARSENICAL COMPOUNDS

AS EMPLOYED IN THE TREATMENT OF DISEASES IN THE UNITED STATES NAVY, 1942

T. J. CARTER
Commander (MC) U. S. N.
WESLEY M. CHAMBERS
Chief Pharmacist U. S. N.
and
LAURA T. ANDERSON

Since November 1924 medical officers of the Navy have been required to make monthly reports of the number of doses of arsenicals administered and a separate report of each case in which ill effects are noted. During the 18 years, 1925–42, in which this information has been compiled, 1,914,519 doses of arsenicals have been administered and 1,153 reactions have been reported.

Previous articles dealing with the information obtained from these reports have been published in the following issues of this BULLETIN:

September 1925.	October 1933.	October 1937.	January 1941.
January 1927.	October 1934.	January 1938.	October 1941.
January 1929.	January 1935.	October 1938.	January 1942.
July 1930.	October 1935.	January 1939.	October 1942.
October 1931.	January 1936.	October 1939.	January 1943.
October 1932.	October 1936.	January 1940.	November 1943.
April 1933.	January 1937.	October 1940.	

Cases of arsenical dermatitis occurring during the year 1942 were published in the November 1943 issue.

The present article includes all cases, except arsenical dermatitis, which were reported during the year 1942. Comparative figures from the experience of previous years are also presented.

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TABLE 1.—*Arsenical reactions, 1942*

Classification	Neoarsphenamine, silver arsphenamine, and mapharsen			
	Mild	Severe	Fatal	Total
Arsenical dermatitis [1]	7	10	0	17
Reactions of minor importance	6	0	0	6
Vasomotor phenomena	3	0	0	3
Liver damage	0	2	0	2
Gastro-intestinal	2	0	0	2
Jarisch-Herxheimer	1	0	0	1
Acute renal damage	1	0	0	1
Arsenical neuritis	1	0	0	1
Polyneuritis	0	1	0	1
Blood dyscrasias [2]	0	0	1	1
Total	21	13	1	35

[1] Case histories were published in the November 1943 number of the BULLETIN. 27 of the above reactions (18 mild and 9 severe) were caused by mapharsen.
[2] The fatal reaction was caused by silver arsphenamine.

TABLE 2.—*Arsenicals administered during the year 1942 for all diseases*

Drug	Doses (grams)				
	0.9 to 3	0.9	0.6 to 0.9	Less than 0.6	Total
Acetarsone:					
Navy	0	0	0	0	0
All others	0	0	0	42	42
Bismarsen:					
Navy	0	0	0	452	452
All others	0	0	0	213	213
Mapharsen:					
Navy	0	0	0	100,330	100,330
All others	0	0	0	8,765	8,765
Neoarsphenamine:					
Navy	0	341	6,250	1,658	8,249
All others	0	9	524	974	1,507
Silver arsphenamine:					
Navy	0	0	0	5	5
All others	0	0	0	0	0
Sulfarsphenamine:					
Navy	0	0	0	0	0
All others	0	0	0	69	69
Tryparsamide:					
Navy	1,839	0	0	0	1,839
All others	635	0	0	0	635
Total	2,474	350	6,774	112,508	122,106

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TABLE 3.—*Arsenicals administered during the 11-year period, 1932–42, for all diseases*

Drug	Doses (grams)				Total
	0.9 to 3	0.9	0.6 to 0.9	Less than 0.6	
Acetarsone:					
Navy	0	0	0	166	166
All others	0	0	76	771	847
Arsphenamine:					
Navy	0	0	149	10,297	10,446
All others	0	0	7	706	713
Bismarsen:					
Navy	0	0	0	2,481	2,481
All others	0	0	1	1,816	1,817
Mapharsen: [1]					
Navy	0	0	0	359,857	359,857
All others	0	0	0	37,822	37,822
Neoarsphenamine:					
Navy	0	5,781	303,363	382,926	692,070
All others	0	845	39,370	136,973	177,188
Silver arsphenamine:					
Navy	0	0	0	355	355
All others	0	0	0	204	204
Sulfarsphenamine:					
Navy	0	18	397	7,472	7,887
All others	0	8	404	13,483	13,895
Tryparsamide:					
Navy	36,323	0	0	13	36,336
All others	17,495	0	2	8	17,505
Total	53,818	6,652	343,769	955,350	1,359,589

[1] First administered in 1935.

TABLE 4.—*Deaths and severe reactions following the administration of 1,364,814 doses of neoarsphenamine, 1925–42; ratio of deaths and severe reactions to doses*

	Deaths		Severe reactions		Deaths and severe reactions	
	Number	Ratio to doses, 1 to—	Number	Ratio to doses, 1 to—	Number	Ratio to doses, 1 to—
Hemorrhagic encephalitis	16	85,301	1	1,364,814	17	80,283
Arsenical dermatitis	13	104,986	204	6,690	217	6,289
Vasomotor phenomena	6	227,469	57	23,944	63	21,664
Blood dyscrasias	8	170,602	20	68,241	28	48,743
Acute renal damage	2	682,407	5	272,963	7	194,973
Acute yellow atrophy of the liver	2	682,407	0		2	682,407
Vascular damage (probable renal hemorrhage)	1	1,364,814	0		1	1,364,814
Liver damage	1	1,364,814	25	54,593	26	52,493
Jarisch-Herxheimer	0		2	682,407	2	682,407
Gastro-intestinal	0		5	272,963	5	272,963
Polyneuritis	0		1	1,364,814	1	1,364,814
Borderline hemorrhagic encephalitis	0		1	1,364,814	1	1,364,814
Arsenical neuritis	0		1	1,364,814	1	1,364,814
Optic neuritis	0		1	1,364,814	1	1,364,814
Classification undetermined	1	1,364,814	0		1	1,364,814
Total	50	27,296	323	4,225	373	3,659

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TABLE 5.—*Deaths and severe reactions following the administration of 397,680 doses of mapharsen, 1935–42; ratio of deaths and severe reactions to doses*

	Deaths		Severe reactions		Deaths and severe reactions	
	Number	Ratio to doses, 1 to —	Number	Ratio to doses, 1 to —	Number	Ratio to doses, 1 to —
Arsenical dermatitis	0	----------	18	22,093	18	22,093
Blood dyscrasias	0	----------	1	397,680	1	397,680
Hemorrhagic encephalitis	1	397,680	0	----------	1	397,680
Liver damage	0	----------	2	198,840	2	198,840
Polyneuritis	0	----------	1	397,680	1	397,680
Vasomotor phenomena	0	----------	1	397,680	1	397,680
Total	1	397,680	23	17,290	24	16,570

TABLE 6.—*Deaths following administration of arsenical compounds, 1919–42*

Year	Arsphenamine	Neoarsphenamine	Silver arsphenamine	Maph-arsen	Total	Year	Arsphenamine	Neoarsphenamine	Silver arsphenamine	Maph-arsen	Total
1919	3	0	0	0	3	1932	0	4	0	0	4
1920	1	1	0	0	2	1933	0	7	0	0	7
1921	3	1	0	0	4	1934	0	3	0	0	3
1922	0	4	0	0	4	1935	0	2	0	0	2
1923	0	1	0	0	1	1936	0	3	0	0	3
1924	1	2	0	0	3	1937	0	1	0	0	1
1925	0	2	0	0	2	1938	0	3	0	0	3
1926	0	4	0	0	4	1939	0	4	0	0	4
1927	1	4	0	0	5	1940	0	1	0	0	1
1928	0	6	0	0	6	1941	0	0	0	1	1
1929	0	3	0	0	3	1942	0	0	1	0	1
1930	0	3	0	0	3						
1931	0	0	0	0	0		9	59	1	1	70

NUMBER OF PERSONS TREATED FOR SYPHILIS AND OTHER DISEASES

Annually on December 31 each activity reports to the Bureau of Medicine and Surgery, on NAVMED–Form A, the number of persons in that command who have a history of syphilis, and the number of those in the command who were treated during the year with an arsenical compound, heavy metal, or other antiluetic treatment. A report of the number of persons who were treated during the year with an arsenical compound for a disease other than syphilis is also required. This census does not take into account individuals who left the service during the year.

In the following table, treatment data are listed separately for "active service personnel" and "all others." The term "all others" includes Veterans' Administration patients, dependents of naval personnel, and native populations of insular possessions.

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TABLE 7.—*Syphilis and arsenicals, U. S. Navy, 1942*

Item	Persons		
	Navy and Marine Corps	All others	Total
Syphilis census, Dec. 31, 1942	[1] 18,097	.....	18,097
Number of persons treated for syphilis with—			
Arsenicals:			
Bismarsen	16	19	35
Mapharsen	5,306	582	5,888
Neoarsphenamine	763	31	794
Sulfarsphenamine	2	3	5
Tryparsamide	85	29	114
Total persons treated with arsenicals	6,172	664	6,836
Heavy metal compounds:			
Bismuth	5,194	503	5,697
Mercury	40	53	93
Mixed treatment (specific mixture, etc.)	2	0	2
Potassium iodide	55	2	57
Total persons treated with heavy metal compounds	5,291	558	5,849
Number of persons treated for disease other than syphilis with—			
Arsenicals:			
Bismarsen	46	1	47
Mapharsen	454	18	472
Neoarsphenamine	1,108	16	1,124
Fowler's solution	2	0	2
Total persons treated with arsenicals	1,610	35	1,645
Heavy metal compounds:			
Potassium iodide	14	0	14

[1] 94.16 percent complete.

In table 7 it will be noted that 1,610 persons in the Navy and Marine Corps were treated with arsenical compounds during the year 1942 for diseases other than syphilis. These diseases were: Angina, Vincent's, 1,295; gingivitis, 85; gingivitis, Vincent's, 137; malaria, 14; tonsillitis, acute, 16; ulcer, skin, 17; and other diseases and conditions, 46.

Of the persons in the group "all others" treated for diseases other than syphilis, 20 were treated for angina, Vincent's; 5 for yaws, and 10 for other diseases and conditions.

VASOMOTOR PHENOMENA

NEOARSPHENAMINE

Case 18–1942.—After exposure to infection, this patient developed a penile lesion, a darkfield examination of which was positive for Treponema pallidum.

From 2 December 1940, to 7 February 1941, he received 5.7 gm. of neoarsphenamine, and from 18 March to 24 September 1941, he received 6 gm. (number of injections not reported).

A third course of arsenical treatment began with a 0.03 gm. injection of mapharsen on 16 July 1942, followed by 0.06 gm. injections on 23 and 30 July, 6, 13, and 20 August; a 0.3 gm. injection of neoarsphenamine on 27 August and 0.6 gm. injections on 4 and 10 September.

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Immediately after the last injection of neoarsphenamine the patient developed nausea, malaise, headache, and exhaustion. The temperature was 101° F. The following morning definite purpuric spots, 1 to 2 mm. in diameter, were noted on forearms, wrists, ankles, and chest. The patient stated that he had always been nauseated following the administration of an arsenical. Recovery was complete in 36 hours.

MAPHARSEN

Case 19–1942.—After exposure to infection on 18 February 1942, this patient was given a diagnosis of syphilis because of a positive darkfield examination.

Antiluetic treatment began with a 0.03 gm. injection of mapharsen on 2 April 1942, followed by 0.06 gm. injections on 6 and 13 April and a 0.03 gm. injection on 4 May.

Three hours after the injection on 4 May the patient complained of headache, vertigo, weakness of extremities, and pyrexia. There were no gastric symptoms. His face was flushed, his skin was warm, the pulse was full and regular. The temperature reached 104° F.

Treatment given for the reaction consisted in administering abundant fluids orally with sodium chloride, grains 10 every 4 hours, bed rest, ice cap, and alcohol sponge baths. Recovery ensued in 6 days.

Case 20–1942.—After exposure to infection on 4 May 1942, this patient developed an indolent primary penile sore. Darkfield examinations were unsatisfactory. Wassermann reaction was 4-plus on 6 July. The sore showed no tendency to heal until arsenical treatment was started.

Arsenical treatment began with a 0.06 gm. injection of mapharsen on 8 July 1942. Less than 1 hour after the injection the patient developed headache, nausea, vomiting, hematemesis, and emotional manifestations, followed by fever.

Calcium was given by mouth. This was expelled by vomiting. One gm. of calcium gluconate then was given intravenously 45 minutes after onset of symptoms and was well tolerated. Complete recovery occurred in 12 hours.

GASTRO-INTESTINAL

MAPHARSEN

Case 21–1942.—After exposure to infection this patient developed a chancre on prepuce on 15 June 1942. Four days later a darkfield examination was positive for Treponema pallidum. A Kahn blood test on the same date was 4-plus.

Arsenical treatment began with a 0.03 gm. injection of mapharsen on 19 July followed by 0.06 gm. injections on 26 July, 1, 8, and 15 August.

One and one-half hours after the third injection the patient developed headache and nausea which lasted for 4 hours. Headache, nausea with vomiting, and vertigo followed the fourth injection and lasted for 24 hours. The symptoms recurred after the fifth injection, and again lasted for 24 hours. There was an elevation of temperature after the fourth and fifth injections.

Arsenical treatment was changed from mapharsen to neoarsphenamine and no further reaction was noted.

Case 22–1942.—This patient developed a penile lesion 17 days after exposure to infection. A darkfield examination was positive for Treponema pallidum.

Arsenical treatment began with a 0.3 gm. injection of neoarsphenamine on 28 September 1942, followed by 0.6 gm. injections on 29 September and 2 October, and a 0.06 gm. injection of mapharsen on 6 October.

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Four hours after the last injection the patient complained of chills, vomiting, diarrhea, and pains in the stomach. His temperature was 102° F.; pulse, 92; and blood pressure 120/80. The symptoms gradually subsided under treatment. Recovery followed in 3 days.

JARISCH-HERXHEIMER

MAPHARSEN

Case 23–1942.—After exposure to infection on 13 July 1942, this patient developed a penile lesion characterized by a coexisting soft and hard chancre about 8 mm. in diameter. Following healing of the lesion, a symmetrical rash appeared over the patient's body. A generalized muscle soreness and stiffening of his neck likewise were present. Facilities for a Kahn test were not available.

Arsenical treatment began with a 0.03 gm. injection of mapharsen on 15 September 1942.

Two and one-half hours after the injection the patient developed a chill, fever, headache, muscular pains, especially around the neck, and a generalized rash. The occurrence of the chill and temperature was more characteristic of the onset of an exfoliative dermatitis but this fact was disregarded because the patient was in the secondary stage. Temperature may exist at this time due to the generalized infection. No specific treatment was given. Complete recovery occurred in 5 days.

LIVER DAMAGE

NEOARSPHENAMINE

Case 24–1942.—After exposure to infection on 8 March 1942, this patient developed a primary lesion on the scrotum. A darkfield examination was positive for Treponema pallidum. A Kahn blood test was 1-plus on 1 April 1942.

Antisyphilitic treatment began with a 0.3 gm. injection of neoarsphenamine on 24 March 1942, followed by a 0.45 gm. injection on 27 March and 0.6 gm. injections on 31 March and 7 April. Two injections of bismuth salicylate were given as concurrent treatment.

Eight hours after the last injection of neoarsphenamine the patient had an indefinite feeling of malaise but no specific complaint. The following morning he reported at sick call complaining of headache, fever, malaise, nausea, and vague upper abdominal discomfort. Physical examination was essentially negative except for slight injection of the throat. Temperature was 100.2° F.; pulse, 94; respiration, 20. The patient was admitted to the sick list and given 2 phenacetin compound capsules every 4 hours, with abundant fluids.

11 April: Urinalysis was positive for bile and revealed a faint trace of albumin; the specific gravity was 1.021. There was no evident icterus of skin or sclerae. Malaise, anorexia, and vague upper abdominal discomfort persisted. Examination of the abdomen revealed no masses, tenderness, or palpable organs. Patient was started on mild saline laxative daily, high carbohydrate, low fat diet, and given 50 cc. of 50 percent dextrose daily.

17 April: The patient appeared to respond well to the high carbohydrate intake. The daily injections of 50 percent dextrose were discontinued. The urine became negative for bile but continued to show faint trace to 2-plus albumin. Subjectively, the patient felt stronger. The temperature showed a slight daily excursion to 99°F. No further antisyphilitic treatment had been administered up to this time.

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28 April: The Kahn blood test and the urinalysis were negative; icterus index 10. Blood sedimentation showed 12 mm. in 1 hour, with a gradual fall. Antisyphilitic treatment was resumed with a 0.03 gm. injection of mapharsen and had no immediate reaction. Treatment was continued with mapharsen and bismuth under close observation. Recovery followed in 20 days.

Case 25–1942.—One month after exposure to infection this patient developed a lesion on the coronary sulcus. There was marked edema and phimosis obscuring a very deep sore. Darkfield examination of serum obtained by baking the lesion with a heat lamp was positive for Treponema pallidum. A Kahn blood test was 4-plus.

From 6 December 1939 to 14 February 1940, he received 12 injections of neoarsphenamine, a total of 6.75 gm.; from 3 April 1940 to 31 March 1942, he received 40 injections of mapharsen, a total of 2.28 gm.; and from 21 February 1940 to 30 April 1942, he received 44 injections of bismuth.

The sixth course of arsenical treatment began with a 0.03 gm. injection of mapharsen on 5 May 1942 followed by a 0.045 gm. injection on 12 May and 0.06 gm. injections on 19 and 26 May, 2, 9, 18, and 23 June, and 1 July.

The patient was admitted to the sick list 7 days after the last injection. He stated that his joints had been slightly stiff for 1 week, but he did not realize he was ill until 3 days before admission when he lost his appetite, especially for greasy foods. Anorexia was marked with slight nausea. He knows of no difficulty resulting from any part of his specific therapy, except nausea when he forgets to omit breakfast before intravenous arsenicals.

Examination was negative except for a palpable liver 1 inch below the costal margin. Slight but definite yellowish tint to sclera and skin was present. The Van den Bergh test showed 3.0 mg. per 100 cc.

6 July: Van den Bergh—direct reaction was positive, immediate, while the serum bilirubin (indirect reaction) was 6.3 mg. per 100 cc. whole blood.

9 July: Jaundice appeared to reach its peak at this time.

19 July: The patient was returned to duty well after 17 days.

ARSENICAL NEURITIS

NEOARSPHENAMINE

Case 26–1942.—After exposure to infection this patient developed a large superficial ulcer on the left side of the scrotum and 2 smaller ulcers on the penis. A darkfield examination was positive for Treponema pallidum.

Arsenical treatment began with a 0.3 gm. injection of neoarsphenamine on 27 September 1942, followed by 0.6 gm. injections on 28 and 30 September, 2 and 5 October.

Six hours after the last injection the temperature rose to 103° F. and the patient complained of a sore neck and headache. All the laboratory findings were within normal limits. The temperature and tenderness of his neck persisted for several days. Recovery was complete in 4 days.

POLYNEURITIS

MAPHARSEN

Case 27–1942.—This patient was infected on 1 May 1942, and 15 days later an extra-genital lesion appeared on his upper lip. A darkfield examination of the lesion was positive for Treponema pallidum. A Kahn blood test was 4-plus.

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Arsenical therapy was begun with a 0.03 gm. injection of mapharsen on 20 June 1942, followed by 0.06 gm. injections on 24 and 28 June and on 8 July.

Following the 0.03 gm. injection on 20 June the patient had a mild Herxheimer reaction. There was no reaction to the second injection. Between the second and third injections, the patient received an intramuscular injection of bismuth subsalicylate without reaction. The third injection of mapharsen produced a mild reaction similar to the first one. Fever, chills, and aching joints, associated with swelling around the base of the rapidly healing chancre, were characteristics. This was again interpreted as a Herxheimer reaction, aggravated perhaps by the bismuth therapy. This reaction subsided rapidly and the patient was returned to duty. The chancre seemed to be healed, but there was still some thickening of the lip at the center. Bismuth was given in July without ill effects.

After the fourth injection of mapharsen on 8 July the patient felt nauseated and vomited. Vomiting persisted throughout the night. Shortly after vomiting the patient felt a sensation of weakness and of numbness and tingling over the body, particularly in the extremities, which were referred to as "asleep." He was admitted to the sick list and became progressively worse during the evening. The temperature on admission was 99.2° F., and rose to 101° F. in 3 hours. The patient's general condition was poor, he was disoriented, the skin gray, and he was in marked collapse. He had violent chills during the evening lasting several minutes. There was marked muscular weakness and extreme variability in reflexes following admission; there was a definite right ankle clonus.

The triceps and biceps reflexes were slightly diminished over the upper extremities. Quadriceps and ankle reactions were active in both legs. The left foot could not be plantar flexed. A paralysis of the anterior tibial group was exhibited, and there was considerable tenderness to palpation in the left calf and both left and right thighs.

Gastro-enteritis and multiple neuritis with early intra-ocular optic neuritis (papillitis) caused by arsenic in the form of mapharsen given in leutic treatment were considered the probable diagnosis.

The treatment consisted of bedrest and daily intravenous administration of 1 gm. sodium thiosulfate. Body massage was given twice daily and infra-red therapy to the extremities. Thiamine chloride in doses of 10 mg. was prescribed twice daily for 2 weeks. A plaster cast was placed on the left foot to prevent foot drop; the cast was bivalved after the third day, and was discontinued after 6 days. Complete recovery occurred in 14 days.

RENAL DAMAGE

MAPHARSEN

Case 28–1942.—After exposure to infection, this patient developed a primary lesion on the frenum of the penis. Darkfield examination however was negative. One month later a rash appeared, typical of secondary syphilis and associated with moderately enlarged glands. A Kahn blood test was 4-plus.

The patient received 10 injections of mapharsen from 16 October to 25 December 1941 and a second course of 10 injections of mapharsen from 3 April to 5 June 1942. Thirty 0.13 gm. injections of bismuth subsalicylate were given as concurrent treatment.

A third course of arsenical treatment began with a 0.03 gm. injection of mapharsen on 10 July 1942, followed by 0.06 gm. injections on 17, 24, and 31 July, a 0.03 gm. injection on 14 August, and a 0.015 gm. injection on 11 September.

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This course of treatment was interrupted because of occasional albuminuria sufficiently severe to place him on the sick list for observation. Albuminuria cleared up, but immediately recurred after the 0.015 gram injection on 11 September. No specific treatment was given as the patient was not incapacitated at any time. The time of complete recovery was not reported.

FATAL REACTION

SILVER ARSPHENAMINE

Case 29–1942.—This patient was admitted to the sick list on 19 February 1932 with typical macular luetic rash and generalized adenopathy. At that time he denied knowledge of any primary lesion nor was there any visible evidence of one having been present. The Kahn blood test on 18 February 1932 was 4-plus. The diagnosis of syphilis apparently was made on this evidence.

Intermittent treatment with arsenicals and heavy metals was instituted immediately. From 19 February to 23 September 1932, he received 16 injections of arsphenamine and from 19 January to 14 September 1933, 12 injections of neoarsphenamine. Arsenical treatment was stopped on 14 September because of the appearance of a dermatitis which was suspected of being due to arsenic.

Blood serology was intermittently negative and positive between the years 1933 and 1941. On 24 April 1941 arsenical treatment was resumed, and from 24 April to 17 July he received 6 injections of mapharsen. All spinal fluid examinations were negative until 17 October 1941, at which time an examination revealed the following: Cell count, 5; globulin, moderate increase; Kahn, 2-plus; colloidal gold, 23444311000. A re-examination of the spinal fluid on 10 November 1941 was as follows: Cell count, 19; globulin, no increase; Kahn, negative. colloidal gold, 2322210000.

The patient was hospitalized on 26 August 1942 for further treatment. Physical examination including neurological, cardiac, ophthalmological, and serological consultations, revealed the following: 26 August: Kahn test, 3-plus; 28 August: Spinal fluid examination, cell count 7; globulin, negative; protein, 25 mg.; Kahn test, positive. The only other abnormal finding was a marked pallor of both optic discs, particularly at the inferior temporal poles.

The administration of neoarsphenamine was begun on 9 October 1942. Following his third injection (0.75 gm.) on 23 October the patient had a nitritoid reaction. At this time he complained of nausea and dizziness. He was put to bed at once. His pulse was rapid and thready; his face assumed an expression of anxiety; he became dyspneic and complained of severe pains in his back. He vomited several times within a few minutes after the injection. Epinephrine was administered intravenously and routine shock treatment instituted. The reaction lasted about 2 hours and the patient was free of all symptoms on the following morning.

Arsenical medication was stopped but 3 injections of iodobismitol were administered. Spinal fluid examination at this time was as follows: Cell count, 0; globulin, positive; protein, 30 mg.; Kahn, positive; colloidal gold curve, 5542111000.

Arsenical therapy now was considered advisable and resumed; silver arsphenamine was substituted for neoarsphenamine.

A 0.2 gm. injection of silver arsphenamine was administered on 16 November and 0.3 gm. injections continued weekly until 22 December. Just prior to his 7th injection the patient developed an eczematous purpuric dermatitis on the inner surface of his right arm. A careful examination of the remainder of his

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body revealed 2 similar but smaller areas on the trunk. Arsenicals were discontinued immediately.

On 13 January the diagnosis of poisoning, therapeutic, chronic, silver arsphenamine, syphilis was recorded.

In spite of 28 transfusions of whole blood, totaling 9,600 cc., the patient's blood picture did not improve. A hematuria developed, his temperature ranged from 99° F. to 106° F. and he became incontinent both as to urine and feces throughout the last 3 weeks of life.

Treatment with intramuscular injections of concentrated liver extract was instituted. Injections of pentnucleotide likewise were given but were discontinued because of nausea and pain at site of injection.

TABLE 8.—*Blood picture*

Date	RBC	WBC	Hb	Plate	Juvs	Bands	Segs	Lymphs	Eos	Monos	Basos	Retics
12-28-42	4,150,000	5,200	11.5			10	52	36	1	1		
1-11-43	3,010,000	4,100	9.3	144,480		8	28	55	2	7		
1-13-43	2,110,000	2,400	10	132,000	1	5	22	64	3	5		
1-14-43	1,590,000	3,150	8.5			2	29	66		3		
1-15-43	2,650,000	2,100	8.5	85,813	2	8	25	54	1	10		
1-16-43	3,020,000	1,500	8.75			4	24	68		4		
1-17-43	2,700,000	1,700	8.6	64,800			28	70		2		0.2
1-18-43	2,720,000	2,500	9.75				36	58	2	4		.7
1-19-43	3,170,000	1,650	9.5	155,330		2	15	74	1	8		.4
1-20-43	3,770,000	1,650	9.5	84,480		2	25	73				.2
1-21-43	3,120,000	2,200	9	40,490		7	20	61	1	9		.3
1-22-43	3,500,000	2,700	9.8			1	19	65		12		.1
1-23-43	3,500,000	2,500	9.75	90,870		4	26	66	1	3		.2
1-24-43	2,250,000	1,250	6	68,580		4	35	63	4	3	1	.1
1-25-43	3,560,000	1,150	10.2				32	66		2		
1-26-43	3,050,000	1,550	9.6			4	26	67		3		
1-27-43	3,960,000	1,550	11.8	99,000		3	28	67		2		.4
1-28-43	4,055,000	1,600	9.6	101,375			22	75		3		.1
1-29-43	3,770,000	1,250	10.9	70,840		4	24	68		4		.2
1-30-43	3,510,000	1,800	10.5			2	20	72	1	5		
2-1-43	3,600,000	1,800	11.9			8	17	69		6		.2
2-2-43	3,510,000	1,550	9.9			2	39	57		2		
2-3-43	3,980,000	1,450	9.8	87,560		3	27	64	1	5		
2-4-43	3,330,000	1,400	10.8	73,260			35	60	1	4		.1
2-5-43	3,940,000	1,500	11.1	86,680		1	19	67	1	11	1	.2
2-6-43	3,830,000	1,950	10.2	88,060			26	68		6		.2
2-7-43	3,690,000	1,500	13.5	173,130		4	30	62		4		.1
2-8-43	3,770,000	1,450	9.5	79,170		1	32	64	1	2		.1
2-11-43	4,210,000	1,100	11.9	99,080		1	27	69		3		.2
2-14-43	5,310,000	1,600	13.5	94,080		3	36	54		7		.1
2-16-43	3,030,000	1,300	9.3	67,500			38	55		7		.1
2-18-43	2,390,000	1,650	8.3	44,960		3	40	50		7		.1
2-19-43	2,620,000	1,300	5.5	33,000			26	68		6		.1
2-20-43	2,150,000	1,050	6.5	23,650		2	36	54		8		.1
2-21-43	1,860,000	1,550	5	52,080		2	51	42		5		.3
2-22-43	2,020,000	1,000	5.8	23,000		1	56	39		4		.2
2-23-43	2,100,000	1,050	5				38	58		2	2	

The patient died 72 days after the onset of symptoms and postmortem examination provided the following gross anatomical diagnoses:

1. Poisoning, chronic, therapeutic, silver arsphenamine, syphilis.
2. Anemia, aplastic.
3. Hemorrhage, multiple, purpuric skin, nasal and buccal mucous membranes, subcutaneous tissues, lungs, kidneys, ureters, bladder.
4. Bronchopneumonia.
5. Jaundice, hemolytic, acquired.
6. Suppression, urine.

Examination of the organs showed that both lungs were large and heavy. There was complete hemorrhagic consolidation in the left lower and right lobes. The remaining lobes were generally pale with scattered blotchy hemorrhages. The bronchi and trachea were hyperemic and there was hemorrhagic, mucoid material in their lumina. The heart was of normal size except for moderate dilatation of the right chambers. The valves and great vessels were normal.

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The myocardium was rather soft. Both kidneys were enlarged by distention of the pelves. The contents of the pelves and ureters were diffusely hemorrhagic. Blood had escaped into the walls of the ureters and lumina had been focally reduced so as to interfere with drainage. The bladder was distended and contained clotted blood and urine. The region of the trigone showed incrustation with salts and focal hemorrhage. The spleen was soft, brownish-red, and weighed 250 grams. The malpighian corpuscles were not visible. The liver was browner than normal and weighed 2,000 gm.; the internal markings were indistinct. The gallbladder was small but otherwise normal. The main bile ducts were slender and not obstructed. No significant abnormalities were found in the gastro-intestinal tract, adrenal glands or the pancreas. The brain, removed after embalming, was normal in external appearance. The meninges were clear and there was no bleeding into the subdural or subarachnoid spaces.

REACTIONS OF MINOR IMPORTANCE

NEOARSPHENAMINE

Case 30–1942.—This patient was exposed to infection in December 1941, and was given a diagnosis of syphilis on 19 March 1942 because of a 4-plus Kahn blood test.

Arsenical treatment began with a 0.3 gm. injection of neoarsphenamine on 31 March 1942.

Eight hours after the injection of neoarsphenamine the patient developed fever, malaise, pain in the chest, vomiting, and swelling around the eyes and face. Urinalysis and blood count were irrelevant.

Bed rest, and 5 minims of epinephrine ½ hour after onset of symptoms resulted in complete recovery 4 days after onset.

MAPHARSEN

Case 31–1942.—Two months after exposure to infection on 29 January 1942 a Kahn blood test made on this patient was 2-plus.

Arsenical treatment was instituted with a 0.045 gm. injection of mapharsen on 24 March 1942, and 4 hours later the patient was admitted with a temperature of 102.4° F. The following day the temperature rose to 103° F. Urine was negative except for the green reaction.

He was given 1 gm. of sodium thiosulfate and recovered in 2 days. A subsequent injection of 0.02 gm. of mapharsen on 31 March resulted in no side reaction.

Case 32–1942.—This patient was exposed to infection on 3 January 1942. A diagnosis of syphilis was established by positive darkfield examinations.

Arsenical treatment began with a 0.03 gm. injection of mapharsen, and 6 hours later the patient experienced dizziness, followed by fainting. The temperature was 99° F. The patient was put to bed with no specific treatment. Recovery occurred 12 hours from onset of symptoms.

Case 33–1942.—After exposure to infection on 25 August 1942, this patient developed a penile lesion; a darkfield examination was positive for Treponema pallidum.

Arsenical treatment began with a 0.06 gm. injection of mapharsen on 6 October 1942, followed by 0.06 gm. injections on 11, 16, and 23 October.

Eight minutes after the last injection clinical manifestations of reaction were anaphylactic shock, pallor, loss of consciousness, and an imperceptible pulse. He was given ½ cc. of epinephrine hydrochloride and 5 minutes later fully regained consciousness. Recovery was complete in 2 hours.

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Case 34–1942.—After exposure to infection, this patient developed a typical chancre on the prepuce. A darkfield examination was positive for Treponema pallidum and a Kahn blood test was 4-plus.

Antiluetic treatment was begun with a 0.02 gm. injection of mapharsen on 25 February 1942. He received 6 injections of bismuth as concurrent treatment.

Five and one-half hours after the injection of mapharsen, the patient developed a chill with a temperature of 100.6° F.; pulse, 120; and respiration, 20.

Supportive treatment of bedrest, application of blankets and hot water bottles, and administration of sodium thiosulfate, 1 gm. intravenously resulted 6 hours later in complete recovery.

Case 35–1942.—After exposure to infection on 1 March 1942, this patient was given a diagnosis of syphilis because of positive darkfield examinations.

Antiluetic treatment was instituted with a 0.03 gm. injection of mapharsen, and 5½ hours later the patient developed chills, followed by fever of 103.2° F., headache, and slight dizziness.

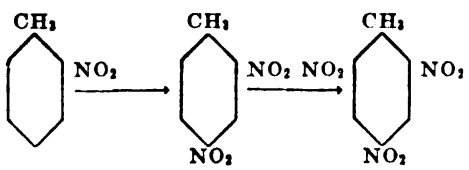
He was treated by bedrest with application of an ice cap and recovery resulted in 12 hours from onset of symptoms.

THE EFFECT OF TRINITROTOLUENE ON THE FORMED ELEMENTS OF THE BLOOD

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Trinitrotoluene was first synthesized in the laboratory in Germany by Hepp in 1880, but it was 1902 before the German military authorities adopted it for filling shells, other countries soon following suit. TNT is one of the most stable explosives known and when heated does not ignite until a temperature of about 300° C. is reached, with no explosion occurring unless it is confined in a closed space.

There are six possible isomers of TNT, but the bulk of commercial TNT is the 2:4:6 variety, or "symmetrical" isomer. It is built up by the progressive nitration of toluene, a coal-tar distillate. Trotyl, as TNT is sometimes called, is a pale yellow powder which melts at 81° C. and is soluble in acetone.



Toluene 2:4 Dinitrotoluene 2:4:6 Trinitrotoluene

Prior to 1915, TNT was considered to be without danger to handlers. The first report demonstrating the toxic effects of this substance was published by Collis (*1*) in 1915. He called attention to the fact

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that there had been 50 fatalities due to jaundice among the thousands of TNT workers during a few months of that year. In this report is also found the first mention of blood changes in individuals exposed to TNT. The presence of nucleated red cells, polychromatophilia, and anisocytosis and poikilocytosis was mentioned. Subsequently a considerable literature on the subject has accumulated both abroad and in this country, with the result that many toxic manifestations were attributed to the product. Consequently it has been difficult to procure a sufficient number of employees to process the explosive in quantities great enough to satisfy the commercial and military demands.

While it is true that numerous toxic effects are directly attributable to working with TNT, we believe that with proper precautionary measures for the protection of workers, these ill effects can be minimized if not eliminated. It is interesting to note that the various commercial insurance companies do not list the handling of TNT as an especially hazardous occupation (*2*).

Panton (*3*) in 1917 reported 28 cases of toxic jaundice, in 4 of which he found such major blood changes as those of aplastic anemia. A large percentage of his patients showed a leukocyte count often above 10,000 per cu. mm., with a relative neutrophilia. These findings characteristic of aplastic anemia in TNT handlers have been substantiated by others, including Livingstone-Learmonth and Cunningham (*4*), Voegtlin, Hooper, and Johnson (*5*), and others (*6*) (*7*) (*8*).

Minot (*9*) made an extensive study of 233 TNT handlers, essentially unselected. Blood counts were taken at random, usually not more than one determination being made on each patient. He found that 83 percent of those studied exhibited polychromatophilia and a smaller percentage a reticulocytosis. Some investigators, as Stewart (*10*), were of the opinion that the white-cell changes were more conspicuous than those of the red cells. Monfort-Sales (*11*) some 20 years later demonstrated the presence of poikilocytosis and anisocytosis in a group of TNT handlers who were not seriously ill.

The employees in this study were all in very intimate contact with TNT. The processes with which they are concerned begin with the pouring of flaked TNT from wooden boxes into buckets. These buckets are then emptied into steam kettles where the TNT is heated to about 90° C. At this temperature the atmosphere of the room becomes saturated with the explosive vapor. The melted TNT is finally poured into specific types of containers for military use as explosive charges. The working day consists of 8 hours with a ½-hour lunch period. Because of the great demand for ordnance workers, the previous regulations calling for a shift of the place of employment to an inert area every 2 weeks has been discontinued. This, of course, means that a careful watch is maintained for untoward symptoms in

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the workers. These trained men must be kept on the job in sufficient numbers to satisfy the present military requirements. All the workers in this study were employed at a naval mine depot in this intimate association with the explosive for a consecutive period of at least 6 months, most of them for 1 year or longer.

Certain precautionary measures have been instituted, including daily change of clothing and compulsory showers for the workers, the routine determination of TNT in the air according to the modified Kay method (*12*) and other well established hygienic measures. These safeguards have been discussed in detail by one of us (T. E. C.) and are to be published in the near future.

A brief clinical picture of the toxic manifestations of TNT poisoning includes cyanosis, mucosal pallor, general apathy, epigastric distress, scanty urine, and skin rashes as the chief symptoms. Physical findings frequently reported include toxic jaundice, pallor, dermatitis, hepatomegaly and splenomegaly, and costovertebral tenderness.

Icterus in any degree must always be viewed as of extreme gravity, as it probably represents the first visible sign of toxicity. During the course of our contact with the workers included in our study, which covers a period of almost 2 years, only a few cases of mild dermatitis and cyanosis were noted. A few workers experienced some of the previously enumerated symptoms but only in mild degree and for short periods.

Complete blood counts were made weekly for a period of 8 weeks on the 17 workers whose duties were as described. Because of lack of laboratory facilities, we were unable to make any other blood studies.

Table 1 indicates the weekly erythrocyte count of each worker for a consecutive 8-week period. There is seen to be little or no significant change in the actual number of erythrocytes present in the blood during this period, allowing for slight normal individual variation from week to week. Further, none of the workers shows any appreciable anemia.

TABLE 1.—*Erythrocytes in millions*

Patient	7-21	7-28	8-4	8-11	8-18	8-25	9-1	9-8
1	5.4	5.4	4.9	5.5	3.9	4.5	5.0	5.2
2	3.3	3.7	4.2	5.0	4.3	3.9	4.1	4.0
3	3.8	4.0	3.9	4.1	4.0	3.5	3.9	3.8
4	5.4	5.4	5.5	4.9	6.0	5.1	5.4	6.0
5	4.7	4.6	5.0	4.9	4.8	4.3	4.5	4.9
6	3.8	3.9	3.8	4.0	3.8	4.1	3.6	3.9
7	4.2	5.0	4.7	4.9	4.3	4.6	4.6	4.5
8	4.9	4.7	5.1	5.0	4.2	4.9	4.2	5.0
9	3.1	3.5	3.9	3.5	3.7	3.9	3.4	3.0
10	4.1	4.0	3.9	4.3	4.1	4.3	3.9	4.0
11	5.0	4.5	5.1	4.9	4.6	5.0	5.3	5.2
12	3.4	4.9	4.0	4.2	4.4	4.0	3.6	4.6
13	5.6	6.0	5.9	6.0	5.8	6.1	5.7	6.0
14	4.3	4.2	5.0	4.0	4.6	4.8	5.0	4.91
15	4.3	4.0	4.0	4.9	4.7	4.9	4.6	4.82
16	6.7	7.0	6.9	5.5	5.9	6.4	6.8	5.6
17	5.4	5.4	5.1	6.0	5.4	5.4	5.9	5.81

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Table 2 is a similar tabulation of the weekly leukocyte count. A slight initial leukocytosis may be seen to have been present, but this change is very transitory, the white cell count returning quickly to normal and remaining so for the duration of the study.

Table 3 shows the hemoglobin percentage determinations. These figures reveal that the hemoglobin was not affected during the period of the study. It is definitely not on the anemic side at any time or in any individual determination. Although the hemoglobin determinations were done by the none too accurate Tallqvist method, they were read by all three of us individually and a concensus taken as the final determination. It is regretted that the apparatus for some of the more accurate methods of hemoglobin determination were not available.

Table 4, although showing the eosinophil count of each patient taken weekly, actually represents a complete blood differential study of these patients. No changes of any consequence were found in any of the formed elements of the blood, including the red cells, reticulocytes, white cells, etc., as disclosed on smears, other than a somewhat increased eosinophil count. It is for this reason that only the eosinophil counts are included in table 4. There was no anisocytosis, poikilocytosis, or polychromatophilia present in any of the slides.

TABLE 2.—*Leukocytes in thousands*

Patient	7-21	7-28	8-4	8-11	8-18	8-25	9-1	9-8
1	11.1	9.0	8.5	9.1	13.5	12.1	6.0	8.4
2	12.8	10.7	11.0	4.05	6.5	7.4	9.2	8.52
3	8.65	7.93	9.0	8.02	10.0	9.9	10.0	7.2
4	9.0	6.9	8.0	6.7	7.0	9.0	12.1	10.2
5	3.95	10.0	9.0	6.0	7.5	8.0	8.2	10.1
6	8.45	9.0	8.3	9.1	8.9	8.9	9.1	9.56
7	9.5	9.4	9.1	9.3	9.0	9.0	9.2	9.1
8	10.2	9.9	11.1	7.56	9.9	10.0	9.4	10.1
9	6.3	9.0	7.0	8.0	9.8	11.2	11.1	9.9
10	8.65	7.93	9.0	8.02	10.0	9.9	8.7	9.41
11	9.5	7.1	12.5	4.02	7.4	10.5	9.4	9.6
12	7.9	10.0	9.1	9.1	9.3	9.6	10.1	9.6
13	8.5	8.6	9.0	12.0	14.2	14.4	12.1	13.0
14	9.1	9.0	9.2	10.5	8.6	9.4	10.6	9.8
15	10.1	11.1	9.6	8.5	9.6	10.0	12.2	10.0
16	7.5	8.0	19.0	18.6	20.4	18.7	12.5	11.6
17	10.0	6.3	12.05	15.0	16.1	14.2	9.4	10.0

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TABLE 3.—*Hemoglobin in percentage*

Patient	7-21	7-28	8-4	8-11	8-18	8-25	9-1	9-8
1	94	93	95	94	90	94	91	93
2	87	88	89	88	88	89	90	88
3	96	96	94	95	90	94	91	95
4	87	89	91	95	92	89	90	89
5	90	90	89	90	90	88	90	91
6	96	96	96	94	98	95	94	94
7	93	93	95	92	93	92	94	92
8	89	89	89	89	89	89	89	89
9	91	94	93	93	92	92	93	93
10	90	90	89	92	89	90	91	90
11	94	92	93	93	91	91	92	91
12	89	93	91	91	90	91	91	91
13	93	95	94	95	93	95	94	94
14	91	91	93	90	91	91	93	92
15	91	89	92	94	90	91	93	91
16	90	90	91	93	90	90	91	91
17	94	94	93	95	93	94	92	93

TABLE 4.—*Eosinophils in percentage*

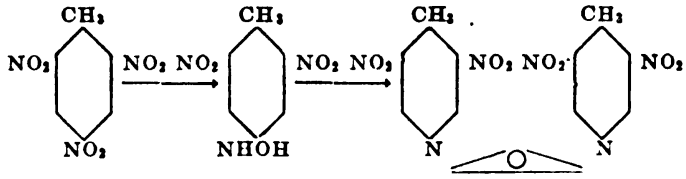
Patient	7-21	7-28	8-4	8-11	8-18	8-25	9-1	9-8
1	4	3	0	4	0	3	2	4
2	2	1	4	2	0	0	4	3
3	0	2	0	0	2	1	2	2
4	4	3	2	3	3	3	0	4
5	0	0	0	1	0	0	0	0
6	0	4	3	2	2	0	2	3
7	2	1	2	3	3	0	2	2
8	0	4	1	3	0	0	2	3
9	0	0	0	0	1	3	0	0
10	6	5	4	6	4	5	7	6
11	2	3	0	1	1	2	1	3
12	6	4	6	5	6	7	4	5
13	0	0	0	0	3	0	1	0
14	8	9	10	9	10	9	8	8
15	0	0	0	2	0	0	0	0
16	4	4	2	6	3	5	4	3
17	4	12	9	14	10	14	15	15

Thus the only significant findings or changes in the formed elements of the blood as brought out by our studies were a slight transitory leukocytosis and a moderate eosinophilia. No subjective or objective symptoms or findings were present in any of these workers in spite of their long-continued and intimate contact with TNT.

In an effort to correlate the results of the Webster test with our blood studies, and to determine its reliability as an index of TNT toxicity, 1,000 Webster tests were performed at various intervals on other employees whose complete blood counts were also studied at the same time. Moore (*6*) first traced the fate of absorbed TNT in the body. He observed that the TNT is reduced within the body to 2,6-dinitro-4-hydroxylamino-toluene, which is readily converted into

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2,6-dinitro-4-azoxy-toluene. The chemical structure of these three substances is shown in the following formulae:



The hydroxylamine derivative is then conjugated with glycuronic acid and is excreted in this form in the urine. It is the hydroxylamine compound which is responsible for the presence of a positive Webster reaction and is the basis of this test. A positive reaction to the Webster test was returned in approximately 100 instances, yet in none of the patients were there any significant changes in the blood picture.

In brief then it will be seen that the only constant findings of the entire study were an initial transitory leukocytosis and a moderate eosinophilia. These changes have apparently in no way affected the well-being of these workers.

CONCLUSIONS

1. TNT has been shown by many investigators to have deleterious effects on the formed elements of the blood, but these findings have not been substantiated by us.
2. A transitory initial leukocytosis accompanied by a moderate eosinophilia is produced in TNT handlers, which in no way affects the well-being of the worker.
3. No other changes were noted in the formed elements of the blood.
4. Proper hygienic measures apparently have succeeded in holding to a minimum any manifestation of TNT poisoning among the workers included in this study.
5. The Webster test is apparently an unreliable guide in detecting early TNT toxicity.
6. The fears previously attached to the handling of trinitrotoluene are without basis provided proper precautionary measures are instituted for the safety of the worker.

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CONDITION RESEMBLING HEMATURIA IN MUNITION WORKERS

A CASE REPORT

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In the past few years, since the outbreak of the war, the study of industrial toxicology has been greatly stimulated and many outstanding advances have been made. Specifically, in the field concerned with the handling of explosives and dyes, it has become almost obligatory to incorporate all aid which may be used to improve the health and efficiency of these workers. During World War I, the incidence of disability following contact with TNT was very high, and several deaths occurred. As a result a commission was assigned in 1917 to study the etiology and prevention of this condition, and among other conclusions reached (*1*) was that: "Proper food during the day is needed to maintain good health and prevent gastro-enteric upsets in handlers of TNT."

A still greater role of diet has come into view in recent years with

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our increasing knowledge and understanding of the action and role played by vitamins in maintaining optimum health. This has been well emphasized recently by Foulger (*2*) (*3*). Having noticed that workers in a hypovitaminotic state are more susceptible to toxic effects of TNT, and that such poisoning responded well to vitamin C therapy (*4*), Foulger, following the original work done on dogs by Voegtlin (*5*), attempted to study its action in the guinea pig. Foulger noted that guinea pigs given TNT, while on an inadequate vitamin C diet, excreted a brilliant red pigment in their urine, which disappeared within a few hours after vitamin C was supplied. Rats treated with TNT usually excreted a small quantity of the red pigment; but if their diets were deficient in heat sensitive vitamins of the B group, the concentration of the pigment in the urine was very much higher than normal.

No record is contained in the literature of this red pigment being present in the urine of workers exposed to TNT except in one unusual and interesting case reported by Foulger.

A skilled technician having duodenal ulcer, had been on an ulcer diet conspicuously vitamin deficient. He had been exposed to TNT, and, during one of his routine medical examinations, a physician noted the bright red color of his urine. Being familiar with the experimental work on guinea pigs, the physician gave the patient ample vitamin C. The red pigment disappeared within 48 hours and did not return. Furthermore it was shown that the color was not due to blood or any of the blood's breakdown products.

In view of the possible industrial importance, a second case of red pigment in the urine of a munition worker with prolonged exposure to TNT, and evidence of vitamin deficiency, is herewith presented.

CASE REPORT

A 49-year-old white male was admitted to the U. S. Naval Hospital, Philadelphia, with the chief complaint of "red bloody urine." He stated that he was a shell loader and always well until 3 days before his admission, when he became slightly intoxicated. The following night the patient felt as if he had a "hangover" with tremor, headache, and a slight stomach upset. He was chilly and yet was perspiring. Two nights later, following a sudden desire to urinate, he noticed for the first time that his urine was deep red in color. This alarmed him as he thought that he was having grossly bloody urine. The red coloration persisted until admission to this hospital. There were no other urinary symptoms such as nocturia, frequency, dysuria or pain. Urgency was only experienced in the initial episode. No other gastro-intestinal or cardiorespiratory symptoms could be elicited.

For the past 2 years this patient has been working with Dunnite, TNT, and smokeless powder. When working with TNT he frequently noticed that his urine turned dark in color. About 5 weeks ago, he worked with a red dye used as a shell marker, but for the past 3 weeks he has had no contact with this substance. Past history and family history were irrelevant. Dietary history

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revealed that he consumed about ½ pint of whiskey daily, with only a moderate food intake. The amount of food eaten is questionable, especially during a debauch. He has lost 10 pounds within the past 2 weeks.

Physical examination showed a well developed and well nourished white male, who did not appear acutely ill. The skin was dry with evidence of recent weight loss. The skin on his face and hands had a yellow tinge, as had the outer surface of his gray hair. Many telangiectases were present on his face and also many dilated vessels. The anterior upper quarter of the chest had many small spider angiomata and the enlarged, obese abdomen showed obvious collateral venous pattern over it extending to the lower half of the chest laterally. The liver was enlarged 5 cm. below the right costal margin. Its edge was smooth, firm, and nontender. No other abdominal masses were palpable and his blood pressure was 150/82. Cystoscopic examination revealed normal bladder mucosa. From both ureteral orifices, a red dye could be seen excreted in good concentration, and apparently in equal amount. A ureteral catheter passed easily to the pelvis of each kidney and no evidence of back pressure or obstruction was noted. A specimen of urine taken during cystoscopy was red brown in color but showed no turbidity as seen in hematuria. Test for occult blood with benzidine was negative. No red blood cells could be seen in centrifuged specimen; tests for albumin and bile were negative. Foam upon shaking was pink-orange tinged. Test for diazotization was positive. Results of retrograde and intravenous urography were essentially normal.

No specific treatment was given except the withdrawal of alcohol and the addition of an adequate unrestricted diet. Within 48 hours after admission his urine became normal in color and reaction.

The total duration of this unusual urinary finding was 5 days; it cleared spontaneously on routine hospital diet.

SUMMARY AND CONCLUSION

1. A case of excretion of a red dye in the urine producing an appearance similar to hematuria, in a munition worker, is described.

2. In vitamin-deficient animals, a similar dye excretion can be produced experimentally following TNT intoxication.

3. A previous case of similar dye excretion in another vitamin-deficient munition worker has been reported. He also responded to vitamin therapy.

4. It is believed that munition workers can be protected from toxic damage by adequate prophylactic administration of vitamins. Questioning as to diet, alcoholism and habits should be a part of the routine examination of these workers

5. From the urological standpoint, an additional condition to be differentiated from true hematuria is presented.

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UTILIZATION OF EMPLOYEES WITH INGUINAL HERNIAS

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This study was undertaken with the following purpose in mind: First, to determine to what exent people with hernial defects are incapacitated for the performance of their regular duties in their normal occupations and how much they are a burden to the dispensaries and hospitals in the performance of surgical operations for such defects; and, second, to investigate the possibilities in the present hours of manpower deficiency of employing men with hernial defects, particularly in the skilled trades.

Prior to 7 December 1941, the presence of a hernia in a man was a positive contraindication to his employment at the Norfolk Navy Yard. After Pearl Harbor, with the tremendous expansion of the yard, the Labor Board found itself very deficient in skilled men to meet the needs of the hour. The Medical Department of the yard was continuously approached with pleas of the Labor Board to pass this or that man because he was urgently needed, and promising not to employ such a man on a job requiring heavy lifting or climbing.

A meeting was arranged between the officers responsible for production in the yard, the Labor Board officials, and the representatives of the Medical Department to arrange for some uniform method of employing such handicapped people. At this meeting it was decided to accept these candidates for limited work, the procedure being as follows:

When an applicant with an inguinal hernia had passed every other part of the physical examination with the exception of his hernia defect, he was given a form known as L. B. Form R–39 which indicated the particular type of heavy work which was interdicted. This he carried to his prospective shop master. If approved, the applicant was accepted, to be employed with the speci-

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fied limitations in mind. If such work, limited in scope to suit the handicapped individual, was not to be found, the master disapproved and the man was rejected.

By questionnaire we obtained the reactions of the shop masters to the continued employment of men with hernias, whether it was convenient for the foremen to assign suitable restricted jobs, whether those men were or were not actually limited to certain jobs as a result of their physical handicaps, and, if they were given restricted jobs, whether they were actually as productive to the Government as if they did not have these defects. Other questions asked were whether the shop masters were in favor of continuing this method of hiring men with hernias and how many hours the men had worked during that time.

Having obtained this information from the productive end of the yard, we turned to the dispensaries. We wanted to know how often the men were reporting for treatment of conditions connected with their hernias. (There is always a possibility that some men knowing of their condition would become chronic visitors to the dispensaries and claim time off with pay for real or feigned disabilities.)

Other points of interest were whether any operations for hernia were performed, and how many days had been lost from work.

There were accepted between 5 May and the end of 1942, 107 men with unilateral or bilateral hernias, with or without the support of a truss. Their occupations ranged all the way from the skilled machinist to that of the unskilled classified laborer. These men were divided between the Norfolk Navy Yard, Public Works Administration, Naval Ammunition Depot, Naval Air Station, and the Naval Supply Depot. We were able to obtain full data on only 94 of those men as some of them were only in training and were not yet put to work and some of them quit their jobs for causes other than their hernias. These men rendered 64,866 man hours, or an average of 679 manpower hours per man during that time. The minimum was 4 hours in the case of a man who figured that he would not make enough to support his family, and the maximum was 1,920 manpower hours.

Of these men, 82.87 percent were not restricted to certain kinds of work and only 17.13 percent, or 16 men, were restricted as a result of their hernias. Of these 16 men only 8 were declared not to be as productive to the government as they would have been if they did not have any hernias. However, other factors entered in to make this last fact less undesirable. One master declared that 2 of these 8 men were 66 and 71 years of age, respectively, and that he did not know but that their advanced ages might have contributed to their lack of productivity. Some men were put in this unfavorable class who had

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hernias and who were also derelict in their duties. How much the mental and how much the physical defect contributed to such an individual's unfavorable status is, of course, difficult to evaluate.

Eighty-four percent of the masters expressed themselves in favor of continuing this method of accepting men with hernias, in spite of the fact that it imposed somewhat of a burden on the employers to find suitable jobs. Only 16 percent of the shop masters expressed themselves against employing men with hernias. Only 2 calls were made to the dispensaries between 5 May 1942 and 31 December 1942, for disabilities resulting from the hernias. There were no sick days lost, nor were there any operations performed for hernias on these men at the expense of the government.

CONCLUSION

Ninety-four men with unilateral or bilateral inguinal hernias were accepted in the Norfolk Navy Yard between 5 May and 31 December 1942. These men rendered the government 64,866 manpower hours, or an average of 679 hours per man. Seventy-eight of these men were employed at their regular work without any regard for their hernia defects. Sixteen were more or less restricted to work not involving heavy lifting or climbing. Eighty-six were as productive as their more physically normal coworkers. Only 8 were less productive. On the basis of their experience 79 percent of the shop masters favored continuation of acceptance of men with hernias. There were only 2 visits made to the dispensaries by these men for disabilities connected with their hernias. There were no days of work lost, nor any operations performed on account of the hernias. This, I believe, is a remarkable record and proves at this time of manpower shortage that men with inguinal hernias can be employed at this and other Navy Yards with perfect safety.

I wish to acknowledge with thanks the cooperation and aid furnished to me by the Labor Board, shops, and the clerical force of the dispensaries in gathering the data for this study.

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STATISTICS

HEALTH OF THE NAVY

The statistics (annual rates per 1,000) appearing in this summary were compiled from data contained in monthly reports of communicable diseases received in the Bureau for the months of July, August, and September 1943:

ENTIRE NAVY

Year	All diseases	Injuries and poisonings	All causes	Communicable diseases		Venereal diseases
				A	B	
1938	332	57	389	7	72	81
1939	325	52	377	3	59	93
1940	386	50	436	16	104	82
1941	338	48	386	15	82	51
1942	341	54	395	12	110	37
1943	361	51	411	15	99	24

FORCES ASHORE

1938	342	52	394	10	92	37
1939	330	50	380	2	78	48
1940	367	50	417	13	114	51
1941	352	49	401	22	95	31
1942	344	47	390	14	116	26
1943	371	50	420	17	108	19

FORCES AFLOAT

1938	327	60	387	5	60	105
1939	322	54	376	4	49	117
1940	403	50	453	19	96	108
1941	324	48	372	9	70	72
1942	333	73	406	9	92	66
1943	322	56	377	8	65	45

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DISABILITIES OR DISEASES CAUSING SEPARATION FROM THE SERVICE

The following table was prepared from reports of medical surveys received in the Bureau during July and August 1943, in which disabilities or diseases causing separation from the service existed prior to entry into the Navy.

Cause	Number of medical surveys	Cause	Number of medical surveys
Abscess, perineal, recurrent	1	Atony, bladder	1
Absence, acquired, gallbladder	1	Atony, anal sphincter	2
Absence, acquired, teeth	3	Atresia, congenital	1
Absence, acquired, testicle	1	Atrophy, cerebral	1
Absence, acquired, toes	3	Atrophy, lower extremity	10
Accessory ribs	2	Atrophy, optic nerve	1
Accessory scaphoid bone, both feet	2	Atrophy, peronei muscles, left	1
Achondroplasia	1	Atrophy, retinal	1
Acne, cystic, face	1	Atrophy, shoulder	1
Acne vulgaris, face	2	Atrophy, upper extremity	5
Acromegalia	1	Blindness	1
Adenoma, thyroid	3	Bronchiectasis	38
Adhesions, abdominal	2	Bronchitis, chronic	11
Adhesions, duodenal cap	1	Bursitis, chronic	6
Adhesions, pleural	2	Calcification, ligament, left knee	1
Adhesions, right ankle	1	Calculus, kidney	5
Albuminuria	8	Calculus, renal	4
Alcoholism, chronic	5	Calculus, urinary system and prostate	1
Allergy, cause unknown	2	Callosity	1
Allergy, gastro-intestinal sensitivity	2	Carcinoma, papillary, bladder	1
Allergy, nasal	2	Cardiac arrhythmia, auricular fibrillation	5
Allergy, multiple	3	Cardiac arrhythmia, heart block	1
Allergy, pruritus ani	1	Cardiac arrhythmia, paroxysmal tachycardia	7
Allergy, with conjunctivitis	1	Cardiac arrhythmia, premature contractions	5
Amblyopia	95	Cardiac arrhythmia, sinus arrhythmia	3
Amblyopia ex anopsia	11	Cardiac arrhythmia, ventricular extrasystoles	1
Amnesia	1	Cardiospasm	3
Anemia, congenital, hemolytic	1	Caries, teeth	3
Anemia, pernicious	1	Cataract	21
Anemia, sickle cell	2	Cataract, traumatic	2
Anemia, splenic	1	Cellulitis	1
Aneurysm, aortic	1	Cerebrospinal syphilis, undifferentiated	5
Aneurysm, carotid	1	Cholangitis	2
Angina pectoris	5	Cholecystitis	1
Angioneurotic edema	1	Cholelithiasis	6
Anxiety state with mental deficiency	1	Chondritis	1
Aortitis	1	Chorea, chronic	1
Aphakia	2	Chorioretinitis	26
Arteriosclerosis, cerebral	3	Choroiditis	7
Arteriosclerosis, general	17	Cicatrix, skin	4
Arthritis, chronic	266	Cirrhosis, liver, atrophic	1
Arthritis deformans	5	Colitis, chronic	2
Asthma	339	Colitis, ulcerative	1
Astigmatism, compound hyperopic	26	Color blindness	4
Astigmatism, compound myopic	43		
Astigmatism, mixed	11		
Astigmatism, simple hyperopic	10		
Astigmatism, simple myopic	3		

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Cause	Number of medical surveys
Conjunctivitis, allergic	1
Conjunctivitis, vernal	1
Constitutional psychopathic inferiority without psychosis	41
Constitutional psychopathic state, criminalism	1
Constitutional psychopathic state, emotional instability	137
Constitutional psychopathic state, inadequate personality	111
Constitutional psychopathic state, paranoid personality	9
Constitutional psychopathic state, schizoid personality	60
Constitutional thrombasthenia (von Willebrand)	1
Contracture	3
Coronary heart disease, arteriosclerotic	10
Coxa vara	1
Cryptorchidism	19
Curvature, spine	12
Cyclitis	2
Cyclothymic personality	1
Cyst, bone	3
Cyst, lung	2
Cyst, popliteal areas	1
Cyst, teratoma, quiescent	4
Cyst, thyroglossal	4
Cystitis, chronic, nonvenereal	1
Dacryocystitis	2
Deafness, unilateral	36
Deafness, bilateral	62
Defective physical development	7
Deformity, acquired	208
Deformity, congenital	125
Dementia paralytica	2
Dementia praecox	169
Dementia pugilistica	2
Dermatitis, atopic	4
Dermatitis, chronic, allergic	1
Dermatitis, contact (cause unknown)	1
Dermatitis, contact, stocking dye	1
Dermatitis herpetiformis	1
Dermatitis, radio	1
Dermatitis venenata	4
Dermatitis, vesicular	1
Detachment, retina	2
Deviation nasal septum	1
Diabetes insipidus	3
Diabetes mellitus	23
Diarrhea, chronic	1
Dislocation, auricular cartilage	15
Dislocation, chronic, lumbar vertebra	1
Dislocation, chronic, recurrent	38
Dislocation, semilunar bone, wrist	1
Dislocation, semilunar cartilage	1
Diverticulum, bladder	1
Diverticulum, duodenum	2
Diverticulum, stomach	1
Diverticulosis, intestinal	1
Duodenitis	9
Dysinsulinism	2
Dysmenorrhea	2
Dyspituitarism	2
Dystrophy, muscular, progressive	1
Ectopy, left kidney	1
Eczema	14
Effort syndrome	22
Elephantiasis, nonfilarial	1
Emphysema, pulmonary	4
Encephalitis, chronic	3
Encephalopathy, post-traumatic	4
Endocarditis, chronic	4
Endocrinopathy, hypogonadism	3
Enlargement, prostate	1
Enuresis	64
Epididymitis, chronic, nonvenereal	4
Epidermolysis bullosa	7
Epilepsy	221
Epilepsy, Jacksonian	4
Epiphyseal separation, traumatic	2
Epiphysitis, dorsal, extreme	1
Epiphysitis, femur	1
Epiphysitis, vertebrae	8
Epithelioma	1
Erythromelalgia	1
Esophagitis	1
Fistula, branchial	1
Fistula in ano	9
Fistula, perineal, urinary	3
Flat foot	232
Foreign body, nontraumatic	1
Foreign body, traumatic	4
Fracture, compound	2
Fracture, simple	13
Fungus infection, skin	2
Gastritis, chronic	27
Gastroduodenitis	2
Gastro-enteritis, chronic	2
Glaucoma	2
Glycosuria	14
Goiter, adenomatous	1
Goiter, exophthalmic	2
Gonococcus infection, cervix, tubes, ovaries	1
Gonococcus infection, joint	1
Gonococcus infection, prostate	44
Gonococcus infection, urethra	1
Gout, acute	1
Gout, chronic	3
Hallux valgus	11
Hammertoe	5
Hay fever	9

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Cause	Number of medical surveys
Headache	32
Heart disease, congenital	18
Heat exhaustion	1
Hemangioma	3
Hemangiomatosis, spinal cord	1
Hematoma, traumatic	1
Hematuria	1
Hemiplegia	1
Hemophilia	1
Hemorrhage	1
Hernia, diaphragmatic	1
Hernia, femoral	1
Hernia, inguinal, direct	1
Hernia, inguinal, indirect	54
Hernia, inguinal, recurrent	2
Hernia, internal, large bowel	1
Hernia, intervertebral disc	5
Hernia, recurrent, after operation	5
Hernia, traumatic	2
Hernia, umbilical	2
Hernia, ventral	1
Hodgkin's disease	2
Hydroa vacciniforme	1
Hydrocephalus	2
Hydronephrosis	6
Hyperchlorhydria	1
Hyperopia	6
Hypertension, arterial	82
Hypertensive heart disease	8
Hyperthyroidism	7
Hypertrophy, bone	2
Hypertrophy, heart	2
Hypochondriasis	5
Hypoproteinemia	1
Hypothyroidism	1
Ichthyosis	2
Insufficiency, ocular muscle	3
Intracranial injury	10
Irritable colon	8
Jaundice, hemolytic	2
Joint, internal derangement of	82
Keratitis	3
Keratoderma	1
Keratosis	1
Labyrinthitis	1
Leukemia, chronic	2
Lichen planus	1
Lichen simplex	1
Loose body in joint	9
Lupus erythematosis	1
Lymphangiectasis	1
Lymphosarcoma	1
Macular degeneration, eye, congenital	6
Malaria	1
Malnutrition	1
Malocclusion, teeth	3
Mastoiditis, chronic	15
Meniere's disease	3
Meningocele	1
Mental deficiency (moron)	17
Metatarsalgia	4
Migraine	46
Myocarditis, chronic	19
Myofascitis, chronic	6
Myopia	97
Myositis, acute	1
Myositis, chronic	63
Myotonia, congenital	2
Narcolepsy	2
Nephritis, acute	1
Nephritis, chronic	28
Nephroptosis	3
Neuralgia	3
Neuritis	19
Neurocirculatory asthenia	1
Neuroma	1
Neurosis, cardiac	1
Neurosis, gastric	17
Neurosis, intestinal	12
Neurosis, stomach	1
Neurosyphilis, serological	3
Nevus, face	1
Night blindness	1
Nystagmus	4
Obesity	2
Obstruction, intestinal	1
Opacity, cornea	5
Opacity, vitreous humor	2
Organic brain disease, post-infectious	1
Osgood-Schlatter disease	9
Osteitis fibrosa cystica	1
Osteitis, post-traumatic, lumbar vertebra	1
Osteoarthropathy, hypertrophic	7
Osteochondritis deformans	17
Osteochondritis dissecans	12
Osteochondroma, femur	5
Osteochondroma, fibula	1
Osteochondroma, 4th cervical spinous process	1
Osteochondroma, multiple	1
Osteochondromatosis	3
Osteoma	4
Osteomyelitis, chronic	11
Osteoporosis, femur	1
Otitis media, chronic	235
Otosclerosis	3
Ozena	3
Pansinusitis	18
Papillitis	2
Paralysis agitans	2
Paralysis, brachial plexus	1
Paralysis, nerve	16
Paralysis, ocular muscle	3
Paralysis, vocal cords	1
Paranoid state	1
Pemphigus	1
Perforated ear drum	6
Perforated nasal septum	1
Perichondritis, right ear	1

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Cause	Number of medical surveys
Periostitis, chronic	2
Peripheral vascular disease	1
Personality disorder, post-traumatic	3
Pes cavus	24
Phlebitis	10
Plantar warts	1
Pleurisy, fibrinous	12
Pleurisy, suppurative	1
Pneumoconiosis (type unknown)	1
Pneumonitis, nontuberculous	2
Pneumothorax	1
Poliomyelitis, anterior, chronic	3
Polypus, 1st sacral segment	1
Polypus, nasal	3
Porencephaly, right parietal	1
Postconcussion syndrome	3
Post-traumatic syndrome	1
Prolapse, rectum	3
Psoriasis	10
Psychoneurosis, anxiety neurosis	200
Psychoneurosis, compulsion neurosis	9
Psychoneurosis, epileptic	1
Psychoneurosis, hysteria	135
Psychoneurosis, mixed	123
Psychoneurosis, neurasthenia	123
Psychoneurosis, psychasthenia	10
Psychoneurosis, reactive depression	2
Psychoneurosis, situational	14
Psychoneurosis, traumatic	18
Psychoneurosis, unclassified	120
Psychoneurotic personality	1
Psychosis, epileptic	1
Psychosis, intoxication, alcoholic	1
Psychosis, manic depressive	27
Psychosis with organic brain disease	1
Psychosis with other disabilities, constitutional psychopathic inferiority	1
Psychosis with other disabilities, epilepsy	1
Psychosis with other disabilities, mental deficiency	8
Psychosis with psychopathic personality	5
Psychosis, unclassified	12
Pterygium	1
Ptosis, congenital	1
Pulmonary fibrosis	3
Purpura hemorrhagica	2
Purpura simplex	1
Pyelitis, chronic	2
Pyelonephritis	2
Pylorospasm	1
Raynaud's disease	1
Retinitis	12
Retinitis, atrophic	2
Retinitis pigmentosa	2
Rheumatic fever	94
Rheumatism, muscular	10
Rhinitis, atrophic	11
Rumination	1
Rupture, cruciate ligaments, left knee	1
Rupture, nontraumatic	1
Rupture, traumatic	14
Salpingitis	5
Sclerosis, combined	1
Sclerosis, disseminated	1
Seasickness	5
Silicosis	3
Simple adult maladjustment	13
Sinus, nose	1
Sinusitis, ethmoidal	2
Sinusitis, frontal	10
Sinusitis, maxillary	18
Somnambulism	36
Spondylitis	15
Spondylolisthesis	12
Sprain, joint	18
Spur, bone	2
Staphyloma, cornea	1
Strabismus	16
Strain, muscular	3
Strephosymbolia	1
Stricture, esophagus	2
Stricture, rectum	1
Stricture, ureter	1
Stricture, urethra	4
Stuttering	1
Sycosis	2
Syncope	11
Synechia	2
Synovitis, chronic	17
Synovitis, traumatic	1
Syphilis	76
Syphilis, seropositive only	1
Tabes dorsalis	1
Talipes	9
Teratoma, testicle	1
Thrombo-angiitis obliterans	5
Thrombosis, coronary artery	2
Thrombosis, external iliac artery	1
Thrombosis, popliteal vein	1
Trachoma	1
Tuberculosis, cervical glands	1
Tuberculosis, epididymis	2
Tuberculosis, general miliary	9
Tuberculosis, inactive, primary	4
Tuberculosis, inguinal lymph gland	1
Tuberculosis, kidney and bladder	1
Tuberculosis, lymph glands	3
Tuberculosis, primary, healed	15

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Cause	Number of medical surveys	Cause	Number of medical surveys
Tuberculosis, pulmonary, chronic, active	37	Valvular heart disease, aortic insufficiency	39
Tuberculosis, pulmonary, chronic, arrested	100	Valvular heart disease, aortic regurgitation	1
Tuberculosis, spine	1	Valvular heart disease, aortic stenosis	7
Tuberculosis, tracheobronchial	1	Valvular heart disease, mitral insufficiency	84
Tumor, brain	1	Valvular heart disease, mitral stenosis	57
Tumor, mixed, activity unknown	8	Valvular heart disease, pulmonic	2
Tumor, mixed, benign	1	Varicose veins	28
Tumor, parotid gland, left	1	Vascular anomaly, rt. brachial plexus	1
Ulcer, cornea	1	Wound, gunshot	2
Ulcer, duodenum	269		
Ulcer, skin	1	Total	6354
Ulcer, stomach	10		
Undulant fever	5		
Union of fracture, faulty	41		
Urticaria	6		
Valvular heart disease, aortic and mitral	32		

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Berkley, William L., Commander (MC) USNR (*Chemotherapy in the Management of Acute Appendicitis*, p. 1). M. D., Vanderbilt University, 1929. Intern, U. S. Naval Hospital, Norfolk, Va., 1929–30. Postgraduate work: Bronch, Vienna University (Austria), 1934; U. S. Naval Medical School, 1935–36; ophthalmology, Washington University, (St. Louis), 1937–38. Certified 1941.

Brill, Harold M., Lieutenant Commander (MC) USNR (*The Effect of Trinitrotoluene on the Formed Elements of the Blood*, p. 241). B. S., University of Chicago, 1925; M. D., Northwestern University Medical School, 1929. Intern, Michael Reese Hospital, Chicago, 1929–31; ward surgeon, Hines Veterans' Hospital, Chicago, 1931–32; associate attending gynecologist, Mt. Sinai Hospital, Chicago, and physician, Mandel Clinic, Michael Reese Hospital; visiting attending physician, Edgewater Hospital, Chicago. Member Chicago Medical Society; Illinois Medical Society; Central Association of Obstetricians and Gynecologists; Chicago Gynecological Society; fellow American Medical Association. American College of Surgeons.

Brown, Robert B., Lieutenant Commander (MC) USNR (*The Treatment of Burns*, p. 59). B. S., Allegheny College, 1929; M. D., University of Pennsylvania, 1933. Instructor in surgery, University of Pennsylvania Medical School; fellow, Harrison Department of Research Surgery. Member Philadelphia Physiological Society; Philadelphia County and Pennsylvania State Medical Societies.

Camp, John D., Commander (MC) USNR (*The Use of Special Views in Roentgenography of the Knee Joint*, p. 56). B. S., 1920, and Ch. B., 1921, Boston University; M. D., Boston University School of Medicine, 1922. Fellow in radiology, Mayo Foundation, 1922–24; assistant roentgenologist Massachusetts General Hospital, 1924–27; visiting roentgenologist, Massachusetts General Hospital; consulting roentgenologist, Palmer Memorial Hospital, Massachusetts Women's Hospital, Leonard Morse Hospital, Boston, Mass., and Westerly Hospital, Westerly, R. I., 1927–28; assistant in roentgenology, Harvard Medical School, 1924–28; associate in roentgenology, Mayo Clinic, 1928–; associate professor of radiology, Mayo Foundation, University of Minnesota, 1928–. Fellow American College of Radiology and diplomate American Board of Radiology; member American Medical Association; Radiological Society of North America (president, 1937); American Roentgen Ray Society; Minnesota Radiologic Society. Associate editor, Radiology.

Coates, Gaines L., Lieutenant Commander (MC) USNR (*Appendicitis in the Navy* p. 7). A. B., University of California, 1924; M. D., University of California Medical School, 1928. Intern, Southern Pacific General Hospital, 1927–28; resident surgeon, Contra Costa County Hospital, Martinez, Calif., 1929–31; private practice, Martinez, Calif., 1931–42; industrial surgeon, Tide Water Associated Oil Co., 1940–41. Member Western Association of Industrial

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Physicians and Surgeons; American Medical Association; Contra Costa County Medical Society.

Cone, Thomas E., Jr., Lieutenant (MC) USNR (*The Effect of Trinitrotoluene on the Formed Elements of the Blood*, p. 241). A. B., Columbia University, 1936; M. D., College of Physicians and Surgeons, Columbia University, 1939. Intern, Lenox Hill Hospital, N. Y., 1939–41. Member Mid-Tidewater Medical Society.

Coventry, Mark B., Lieutenant (MC) USNR (*The Use of Special Views in Roentgenography of the Knee Joint*, p. 56; *Wartime Fractures in the Navy*, p. 34). A. B., 1934, and M. D., 1937, University of Michigan; M. S. in orthopedic surgery, University of Minnesota, 1942. Intern, University Hospital, Ann Arbor, Mich., 1937–38; fellow in orthopedic surgery, Mayo Foundation, 1938–42; orthopedic surgeon, Mayo Clinic; instructor in orthopedic surgery, University of Minnesota. Member Minnesota State Medical Society; fellow American Medical Association.

Cuono, Joseph D., Lieutenant, junior grade (MC) USNR (*Paradoxical Respiration*, p. 136). B. S., New York University, 1932; M. D., New York Medical School, 1936. Intern, Paterson St. Joseph's Hospital, 1936–38; private practice, Paterson, N. J., July 1938–Jan. 1940; assistant resident, surgery, Jan. 1940–July 1940, and resident, thoracic surgery, July 1940–July 1942, Sea View Hospital; assistant thoracic surgeon, Metropolitan Hospital, Flower and Fifth Avenue Hospitals. Member Bergen County Medical Society, N. J.

Denison, Ward C., Commander (MC) USNR (*Retinitis Proliferans—Eales' Disease*, p. 180). M. D., University of Michigan, 1923. Intern, Long Island College Hospital, 1923–24, and St. Lukes Hospital, New York City, 1924–26; assistant surgeon, otology, St. Lukes Hospital, 1926–; clinical assistant New York Post Graduate Hospital, 1926–27; assistant aural surgeon, New York Eye and Ear Infirmary, 1926–; assistant surgeon, otolaryngology, Bellevue Hospital, 1927–34; private practice, New York, 1926–, and New Jersey, 1931–. Member New York County and State Medical Societies; Academy of Medicine; American Medical Association; American Board of Otolaryngology; American Academy of Ophthalmology and Otolaryngology; Bergen County Medical Society (N. J.); fellow American College of Surgeons.

Director, William, Lieutenant Commander (MC) USNR (*Zoster with Varicelliform Eruption*, p. 186). M. D., N. Y. University and Bellevue Hospital Medical College, 1927. Intern, Coney Island Hospital, Brooklyn, 1927; Middlesex Hospital, Middletown, Conn., 1927–28; Kingston Avenue Hospital, Brooklyn, 1928; Montefiore Hospital for Chronic Disease, 1928–29. Certified 1935. Assistant chief, dermatology and syphilology, New York University Clinic; assistant visiting dermatologist and syphilologist, Bellevue Hospital; instructor, dermatology and syphilology, New York University School of Medicine. Member American Academy of Dermatology and Syphilology; American Medical Association.

Downs, T. McKean, Commander (MC) USNR (*An Improved Fluoroscopic Screen*, p. 208). M. D., University of Pennsylvania Medical School, 1921. Private practice, Philadelphia, 1925–41; assistant, then surgeon, Pennsylvania Hospital, 1924, Germantown Hospital, 1924, Bryn Mawr Hospital, 1925; instructor, operative surgery, Graduate School of Medicine, University of Pennsylvania. Member Philadelphia County and Montgomery County medical societies; Delaware Medical Society; Pennsylvania State Medical Society; American Medical

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Association; Academy of Surgery, Philadelphia; College of Physicians, Philadelphia.

Emerson, Kendall, Jr., Lieutenant (MC) USNR (*Tropical Eosinophilia*, p. 118). M. D., Harvard Medical School, 1933. Intern in medicine, Presbyterian Hospital, New York, N. Y., 1933–35; fellow in medicine and experimental therapeutics, Johns Hopkins Medical School, 1935–37, and assistant dispensary physician, Johns Hopkins Hospital, 1935–37; assistant resident physician, Hospital of the Rockefeller Institute, 1939–1942. Member American Medical Association; American Association for the Advancement of Science; Harvey Society; Association for the Study of Internal Secretions.

Ferguson, Lewis K., Commander (MC) USNR (*The Treatment of Burns*, p. 59). M. D., University of Pennsylvania Medical School, 1923. Fellow in surgery, University of Pennsylvania Hospital, 1923–25; year's study in Europe, 1928–29. Private practice, Philadelphia, 1925–. Assistant surgeon, University Hospital, Philadelphia; assistant professor, University of Pennsylvania; surgeon, Student Health Service, University of Pennsylvania; chief of the proctologic clinics, Hospital of the University of Pennsylvania and Philadelphia General Hospital; proctologist, Policemen and Firemen of Philadelphia; chief of the industrial clinic, Hospital of the University of Pennsylvania. Member American Medical Association; American College of Surgeons; Philadelphia Academy of Surgery; American Gastroenterologic Society; Physiological Society, Philadelphia; American Society for Experimental Pathology. Author, Surgery of the Ambulatory Patient, 1942; co-author, Surgical Nursing, 6th edition, 1940; surgical editor, Digest of Treatment.

Finn, Herbert G., Lieutenant (MC) USNR (*Fracture of the Carpal Scaphoid*, p. 38). A. B., Harvard College, 1928; M. D., Harvard Medical School, 1932. Private practice, general and industrial surgery, 1934–; port surgeon in Boston; Lykes Brothers Steam Ship Co., Galveston, 6 years; Ocean Steamship Co. of Savannah, 1941; industrial surgeon for Peabody & Lane, Boston Steamship agents, 6 years; Nacirema Operating Co., stevedores; Atlantic & Gulf Stevedores, 6 years; H. P. Hood & Sons; United Farmers Cooperative Creamery Association, Inc.; examining physician, Massachusetts Institute of Technology; Boston Post Publishing Co.; Boston Globe Publishing Co.; surgical staff, Carney Hospital, 1939–; Chelsea Memorial Hospital, 1940–; Somerville Hospital, 1938–. Member Massachusetts Medical Society; American Medical Association; diplomate of National Board of Medical Examiners.

Gepfert, John R., Lieutenant (MC) USNR (*The Topical Use of Medicated Human Plasma in the Treatment of Burns*, p. 193). B. S. and M. D., University of Georgia, 1929. Intern, Macon Hospital, Macon, Ga., 1929–30; resident surgeon, Macon Hospital, 1930; resident, obstetrics, Lying-in Hospital, 1931; resident, obstetrics, Bellevue Hospital, 1932–33; assistant attending gynecologist, Bellevue Hospital, 1933–41; New York Hospital, 1941–43; instructor, obstetrics and gynecology, New York University, 1933–41; Cornell University Medical School, 1941–43. Member New York County and State medical societies; New York Obstetrical Society; American Medical Association; fellow American College of Surgeons; diplomate American Board of Obstetrics and Gynecology.

Humphrey, Arthur A., Lieutenant Commander (MC) USNR (*Meningococcemia with Waterhouse-Friderichsen Syndrome; Early Recognition by Means of Buffy Layer Smears*, p. 165). B. S., University of South Dakota; M. D., Northwestern University Medical School, 1928. Resident, Iowa Methodist Hospital, Des Moines, Iowa, 1928–29; fellow in pathology, Mayo Clinic, until 1932. Consultant in pathology to the Leila Y. Post Montgomery Hospital,

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Community Hospital, and the Battle Creek Sanitarium, all of Battle Creek, Mich.; consulting pathologist to the Michigan Community Health Project through the W. K. Kellogg Foundation. Member American Medical Association; American Society of Clinical Pathologists; Michigan Pathology Society; State and County societies. Certified by the American Board of Pathology.

Irwin, F. Glenn, Lieutenant Commander (MC) USNR (*Appendicitis in the Navy*, p. 7). M. D., Washington University Medical School, 1930. Internship, Barnes Hospital, St. Louis, 1930–33. Resident surgeon, Presbyterian Hospital, San Juan, P. R., 1933–35; director and chief surgeon, Presbyterian Hospital, San Juan, P. R., 1935–39; associate clinical professor, tropical medicine, Columbia University, 1935–38; associate professor, clinical surgery, Columbia University, 1938–39. Fellow American College of Surgeons; certified by American Board of Surgery, 1940; fellow American Medical Association.

Isard, Harold J., Lieutenant Commander (MC) USNR (*Right-sided Aortic Arch; Report of a Case*, p. 168). M. D., Temple University Medical School, 1934. Intern, Mt. Sinai Hospital, Philadelphia, June 1934–June 1935; staff member, cardiac department, Mt. Sinai Hospital 1935–38; Jewish Hospital, 1936–; private practice, Philadelphia, 1935–. Member American Medical Association; Pennsylvania State Medical Society; Philadelphia County Medical Society.

Jewett, Eugene L., Lieutenant Commander (MC) USNR (*Different Uses for the Walking Stirrup*, p. 196). B. C., Cornell University, 1922; M. D., Harvard University Medical School, 1929. Chemical engineer, Barrett Co., 1923–24; intern, Hartford Hospital, 1931–33; private practice, orthopedic and traumatic surgery, Orlando, Fla., 1934–. Member American Medical Association; Southern Medical Society; Florida State and Orange County Medical Societies.

Kern, Richard A., Captain (MC) USNR (*The Treatment of Burns*, p. 59). A. B., University of Pennsylvania, 1910; M. D., 1914. Instructor, medicine, University of Pennsylvania, 1916–21; associate, University of Pennsylvania School of Medicine and Graduate School of Medicine, 1921–28; assistant professor, 1928–34; professor, clinical medicine, 1934–; assistant physician, University Hospital. American Medical Association; associate American Physicians; American Society for Clinical Investigation; Society for the Study of Asthma (president, 1934); American Clinical and Climatological Association; American College of Physicians; American Association for the Study of Allergy (president, 1931); College of Physicians of Philadelphia; Pathological Society of Philadelphia.

Kinell, Jack, Lieutenant (MC) USNR, (*Yaws; Report of a Case in a White Man*, p. 187). B. S. in medicine, 1934, and M. D., 1936, University of Kansas. Intern, Cleveland City Hospital, Cleveland, Ohio, July 1936–July 1937; fellow in medicine, Cleveland Clinic, Jan. 1937–Jan. 1941; resident in medicine, July 1939–July 1940; private practice, internal medicine and cardiology, Corpus Christi, Texas, Feb.–June 1941; Houston, Texas, June 1941–. Member American Medical Association; Texas State Medical Association; Harris County Medical Society.

Krueger, Albert P., Captain (MC) USNR (*The Diagnosis of Influenza and Catarrhal Fever, Acute*, p. 27). A. B., Stanford, 1925; M. D., 1928. Assistant bacteriologist and experimental pathologist, Stanford, 1927–28; acting instructor, 1928–29; instructor and assistant professor, 1929; associate general physiology, Rockefeller Institute, 1929–31; associate professor, bacteriology, University of California, 1931–38; consultant communicable diseases, student health service,

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and lecturer medicine, medical school, 1932–. Assistant visiting physician University of California Hospital, 1931–; consultant bacteriologist, 1932–; professor of bacteriology, University of California, 1938–; grant, cmt. scientific research, American Medical Association, 1938. A. A.; Society of Bacteriologists; Society of Experimental Biology; Society of Experimental Pathology; American Association of Immunologists.

Lewinski, Robert J., Lieutenant H–V (S) USNR (*Illiteracy*, p. 150). Ph. B., University of Toledo, 1934; M. A., State University of Iowa, 1936; Ph. D., 1939. Director and chief psychologist Child Study Institute, Toledo; lecturer, psychology, University of Toledo. Member American Psychological Association; Midwestern Psychological Association; Ohio Academy of Science.

Litzenberger, Sam W., Lieutenant Commander (MC) USNR (*Condition Resembling Hematuria in Munition Workers*, p. 247). A. B., Wabash College, 1924; M. D., Indiana University School of Medicine, 1927. Intern, Indianapolis City Hospital, 1927–28; Graduate School of Medicine, University of Pennsylvania, 1929–30. Member Indiana State Medical Association; American Medical Association; North Central Branch American Urological Association; American Urological Association; certified by American Board of Urology; fellow American College of Surgeons.

Lozner, Eugene L., Lieutenant (MC) USNR (*Hereditary Hemorrhagic Thrombasthenia with Severe Post-Hemorrhoidectomy Hemorrhage*, p. 161). M. D., Cornell University Medical School, 1937. Intern, Albany Hospital, 1937–38; assistant resident physician, 1938–39; resident physician, Thorndike Memorial Laboratory, Boston City Hospital, 1939–41; assistant in medicine, Harvard Medical School, 1939–41; associate in pathology, George Washington University Medical School, 1942–43. Member American Society for Clinical Investigation; American Federation for Clinical Research (Councilor 1941–48); American Association for the Advancement of Science. Coauthor, Hemophilia, Oxford Medicine 1941.

McLaughlin, Charles W., Jr., Lieutenant Commander (MC) USNR (*Rectus Muscle Strains Simulating Acute Intraperitoneal Disease*, p. 172). B. S., University of Iowa, 1927; M. D., Washington University School of Medicine, St. Louis, 1929. Resident in pathology, Montreal General Hospital, 1930–31; fellow in surgery, University of Pennsylvania Hospital, 1931–34; graduate study, Royal Infirmary, Edinburgh, Scotland, 1934–35; private practice, Omaha, 1935–; assistant professor surgery, University of Nebraska; surgeon, University of Nebraska Hospital, Nebraska Methodist Hospital and Bishop Clarkson Memorial Hospital, Omaha. Certified, American Board of Surgery. Member Nebraska State Medical Society; American Medical Association; Central Surgical Association; American College of Surgeons; Western Surgical Association.

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niley, Dean F., Lieutenant Commander (MC) USNR (*The Incidence of Acute Respiratory Infections; the Experience of the U. S. Navy Since 1881*, p. 17). A. B., Cornell, 1916; M. D., Cornell 1919. Instructor, hygiene and preventive medicine, and assistant medical adviser, Cornell University, 1920–21; assistant professor, hygiene and preventive medicine, and medical adviser, Cornell University, 1922–28; professor, hygiene and preventive medicine and health officer Cornell University 1929–42. One time field investigator for Carnegie Foundation for the Advancement of Teaching, acting director Division of Health and Physical Education New York State Department of Education, president of American Student Health Association. Fellow American Public Health Association and former councilor. Author of school and college textbooks in field of hygiene and preventive medicine.

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'enney, Luman H., Commander (MC) USNR (*Electroencephalographic Diagnosis of Organic Brain Disease*, p. 161). A. B., Oberlin College, 1920; M. D., Western Reserve University Medical School, 1929. American Field Service Ambulance with French Army, 1917. Intern, 1929–31; assistant professor, student health service, Princeton University, 1931–37; resident in psychiatry, Phipps Clinic, Johns Hopkins Hospital, summers of 1929–31; associate professor, Princeton University, 1937. Member American Medical Association; American Psychiatric Association.

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BUREAU OF MEDICINE AND SURGERY,
NAVY DEPARTMENT,
WASHINGTON, D.C.

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UNITED STATES

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PUBLISHED FOR THE INFORMATION OF THE MEDICAL DEPARTMENT OF THE NAVY

XLII NUMBER 2



FEBRUARY 1944

BUREAU OF
DICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

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COVER PHOTOGRAPH

An important terminus for the ambulance planes that transport the wounded and ill from forward areas is the Navy's advance base hospital at Espiritu Santo in the New Hebrides. Outstanding work was performed in 1942–43 at this exteriorly unimpressive, but expertly staffed and modernly equipped, hospital.

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VOL. XLII FEBRUARY 1944 No. 2

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

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ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Contributions to the BULLETIN should be typewritten, double spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have them typewritten.

In submitting articles for publication the author should include a signed statement to the effect that "the opinions or assertions contained therein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large." (Art. 113 (2) U. S. Navy Regulations.)

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The editor regrets to have to say that reprints of articles can no longer be supplied by the Government Printing Office.

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U. S. NAVAL MEDICAL BULLETIN

VOL. XLII FEBRUARY 1944 No. 2

SPECIAL ARTICLES

HIGH EXPLOSIVE FRAGMENTS

THEIR FATE IN THE HUMAN BODY[1]

PAUL MICHAEL
Commander (MC) U. S. N. R.

The local and general effects of bullet wounds have been described by numerous authors on surgical, military, and forensic medicine. We are all more or less familiar with the effects of smoothbore and rifled firearms, and of low-caliber, high-powered weapons (*1*). Because of the slow burning of black powder, the muzzle flash usually burns the target when at close range. Smokeless powder, on the other hand, burning quickly as it does, leaves little or no burning, even at very close range. The effects of the bullet in a human body are determined by the type of tissue involved, or the anatomic location of the projectile. Disregarding all the manifold possibilities of a bullet within the human body, the persistent remains of one in an uncomplicated case usually result in the following pathologic picture, regardless of the composition of the projectile. Eventually a fibrous capsule develops around the foreign body, with production of a hyalinized connective tissue. This reaction varies little from that due to many other types of foreign bodies, and is in no way specific. Apart from the possibilities of lead absorption, the bullet most often remains inert, and becomes walled off.

The present war, however, has been characterized by the wide use of high explosives, particularly those contained within a shell or bomb, and this form of injury accounts for a relatively high percentage of casualties. Injuries from this type of warfare may roughly be classified according to the following three causes:

1. High explosive fragments.
2. Liberation of gas or chemicals.
3. Pressure changes in air or water.

[1] From the Laboratory Department, U. S. Naval Hospital, Oakland, Calif.

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Most of our attention in this field has been focused on the third type, namely, injury due to pressure changes in air or water. Falla (*2*), Lockwood (*3*), Fraser (*4*), Sutherland (*5*), Logan (*6*), and Zukerman (*7*) in Great Britain, and Abbott, Due, Nosik (*8*), and others in this country have called attention to the thoracic, abdominal, and central nervous system lesions from this cause. Their work has established a definite entity.

To understand the process of the fragment type of injury, one should first have some conception of the mechanics of high explosive ammunition. The explosive charge of a bomb or shell is contained within a metal casing, and usually includes sufficient chemical to supply the necessary oxygen to assure combustion. Upon ignition by the detonation, the explosive undergoes combustion and is converted into a gaseous state. With the development of such tremendous pressure, the metal capsule and its contents escape with the liberation of many pleomorphic metallic explosive fragments. In the immediate vicinity of the explosion, a human may be partially disintegrated both by the effects of the explosion and the flying fragments. On the other hand, personnel farther distant would more likely have injuries primarily due to the missiles themselves. Injuries of this nature may again be subdivided, for the purpose of this paper, into:

1. Those causing immediate destruction and disintegration.
2. Those where the fragments lodge in vital organs or tissues with an immediate or ultimate fatal result.
3. Those lodging in bone or soft tissues with injuries resulting which are compatible with life.

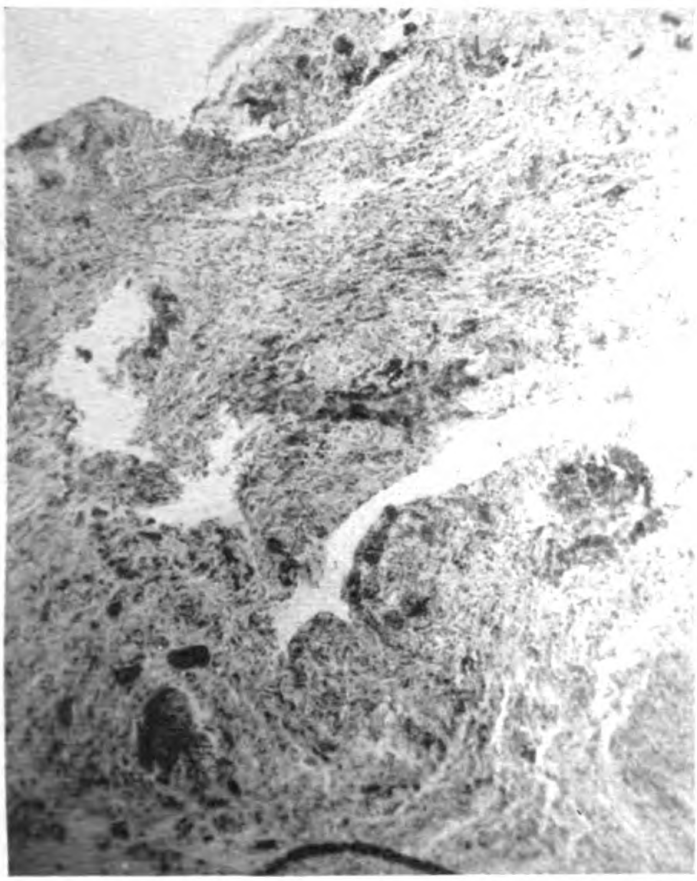
The theme of this paper deals with the missile-type of injury involving the lodgment of metallic fragments in bone or soft tissue without fatality. During the past several months we have had occasion to study 64 patients from whom foreign-body high explosive fragments have been removed. Of this number, 27 have been chosen as being representative of a tissue reaction which is unmistakably different from other foreign-body reactions.

When these fragments were surgically removed from the patient, the surrounding capsules, in whole or in part, were included in the specimens reaching the laboratory. We had observed less than a dozen of these tissues under the microscope when we became aware of the fact that the tissue reactions were significant. Moreover, they appeared so identical and characteristic that soon we were able to make the diagnosis of high explosive foreign-body reaction without having the benefit of the patient's history. In reviewing the clinical and historical data of the patients, 9 were seen to have had single injuries, while 18 had multiple wounds of this character. In all the single injuries, the fragments were in the extremities, while in the multiple

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wounds, the missiles were also found in the brain, chest, or abdomen as well. The longest time interval between injury and surgical removal was 257 days, the shortest 35, with an average of 105 days. Of these various injuries, 9 patients showed involvement of the peripheral nerves. Of the entire group studied, only 2 showed evidence of infection. Tetanus toxoid and sulfonamides were administered in all instances.

In the microscopic consideration of these associated soft tissue masses, note was made of the following characteristic points. There



.1 (×200) Microscopic section taken from the soft tissue surrounding a high explosive fragment. Fragment removed 100 days after injury. Note the palisading of the fibrous tissue, the foreign-body giant cells, and the accumulations of yellow-brown crystalline material (deeply staining particles).

was a granulation tissue of variable age, composed of both mature, hyalinized connective tissue and young proliferating fibroblasts. Accompanying this reaction was a cellular infiltrate composed of endothelial cells, macrophages, round cells, and foreign-body giant cells. The fibrous tissue was frequently seen in whorls and palisades. Vascularity was variable, depending upon the age of the granulation tissue; the younger lesions of course showing a richer capillary response. In some instances, especially when the metallic fragments

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were superficial, fragments of hairs and hair follicles were observed in the granulation tissue. Many of the macrophages contained broken down lipoid material and hemosiderin. The most characteristic finding, however, was the presence of a yellow-brown crystalline material. This was a fine crystalline substance interspersed through the granulation tissue. It was extra-cellular for the most part, but frequently was seen engulfed in foreign-body giant cells. The presence of this material was constant, regardless of the age of the lesion, and there always appeared to be a tissue response manifested by foreign-body giant cells, macrophages, and fibrous tissue proliferation.

Efforts were immediately instituted to ascertain the composition of this substance. Differential stains were made on the tissues to rule out the products of human metabolism. It proved not to be fat or hemosiderin, although these substances were sometimes seen as associated findings. Evidences pointed to the fact that the material was not endogenous. The thought occurred that this crystalline material might possibly be due to microscopic particles of metal. Working upon this assumption, specimens were submitted to the Metallurgy and Geology Departments of the University of California. Their studies established the fact that the foreign body definitely was not of metallic nature. Polariscopic examinations ruled out the possible part played by hair fragments, although, as already mentioned, hair fragments were sometimes seen in these tissues as incidental findings.

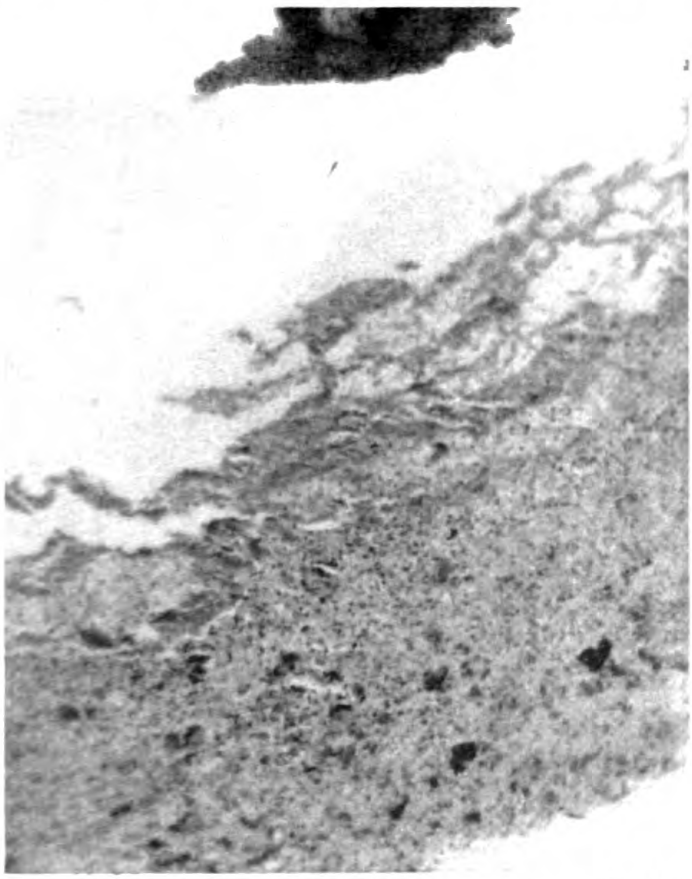
Finally, by a process of elimination, it became apparent that possibly something intrinsically present in the explosive, and adherent to the fragments in microscopic quantities may be the cause of this unique picture.

Working upon this assumption, high explosive powder was obtained from the Mare Island Navy Yard Ammunition Depot, known as "Explosive D." This is presumed to be a close approximation to the explosive material used by the Japanese. The powdered and granular forms of this explosive were used and the results of both were the same. Small quantities of the material were implanted into the thigh muscles of guinea pigs under general anesthesia, and the skin edges closed. Nonabsorbable sutures were used and removed on the fourth day in order to rule out any extraneous effect of buried suture material.

Biopsies were then done at intervals of 15, 30, 90, and 105 days. These were treated in the same manner as that used in the tissues removed from our patients. Paraffin sections were made, sections cut 6μ in thickness and routine hematoxylin and eosin stains made. Differential stains of the same type were repeated according to the

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technic used in the clinical material, namely fat, hemosiderin, Mallory's triple stain, Weigert's stain, and plain methylene blue. At 15 days the reaction could hardly be called specific, but at 30, 90, and 105 days a granulation tissue was observed which approximated in almost every detail that seen in the soft tissue masses of our patients. Foreign-body giant cells, endothelial cells, palisading of the fibrous tissue, and beginning hyalinization were all observed. In addition the sections showed a fine granular and crystalline material of the same histologic appearance as that seen in the tissues surrounding



2. (×200) Soft tissue removed from thigh muscle of animal 90 days after implantation of small quantity of high explosive material. Note the similarity of the foreign-body reaction to that seen in fig. 1, with foreign-body giant cells and accumulations of yellow-brown crystalline material, some of which is being engulfed in foreign-body giant cells.

high explosive fragments. Some of this material was in the process of being engulfed by foreign-body giant cells.

Finally, small amounts of the explosive were taken, placed into solution and permitted to crystallize, and under the microscope the appearance of the crystals was quite similar to the pleomorphic forms seen in the reported cases.

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No toxic symptoms were observed in the animals when the explosive was implanted locally. Curiously enough, however, when in solution and injected intramuscularly, it was definitely toxic. Upon injecting 3 cc. of a 1:500 solution, the animals went into convulsions at 30 minutes and died in 1 hour.

DISCUSSION

Further evidence is needed to prove, beyond any doubt, that high explosive metallic fragments, lodging in the human body, retain enough explosive material to initiate a specific type of foreign-body reaction. It is believed, nevertheless, that sufficient data are herein recorded to report in preliminary form the results of our experiments and observations. Regardless of the cause, it is our belief that a characteristic histologic structure develops which appears to be specific for this type of injury. It contrasts definitely with foreign-body reactions due to other causes, such as bone plates, bullets, needles, bolts, sutures, paraffin, thorotrast, and sulfonamide crystals, and is a lesion *sui generis*. So far as the available medical literature is concerned, this reaction has never before been described.

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TREATMENT OF ANKLE SPRAIN

Immediate and continued active motion and use of a sprained ankle and foot almost irrespective of any local treatment definitely hastens recovery.

The most satisfactory adjunct in the treatment of ankle sprain in order to maintain motion and use of the part is the complete elimination of pain by the injection of 2 percent procaine hydrochloride solution into the injured ligaments.—McMaster, P.: J. A. M. A. 122: 660, July 3, 1943.

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WORKING RULES IN THE FIELD

SOME GENERAL POINTS OF INTEREST[1]

EMILE HOLMAN
Commander (MC) U. S. N. R.

[This contribution by Dr. Holman seems to the editor to be of such timely appeal and so succinctly explicit, that it is published as submitted, without any attempt by author or editor to develop it in a more orthodox form.]

Combat troops should be instructed before battle to seek cover at once when wounded. They should try to drag or roll themselves out of the clear. Corpsmen should avoid going into open, exposed-to-fire areas except under great precautions of camouflage or in twilight. When available camouflaged dressings, dyed green, should be used. Bandages and slings may be smeared with dirt after application.

Avoid giving a lightly wounded man ½ grain of morphine, which may convert a walking wounded into a stretcher case.

Avoid the use of the tourniquet. It should be applied only if a pressure dressing, clamp, or ligature cannot be applied effectively, or if control of bleeding fails despite their use. A large spurting vessel should be clamped, and the clamp included in the dressing. The tourniquet may be used when the part of the limb distal to the wound must be amputated. Every effort should be made to get the patient with a tourniquet to a station capable of giving proper treatment within an hour.

A liberal application of sulfonamide powder in the depths of the wound should be attempted at the very first dressing, whether done on the field or at the first dressing station. The sooner sulfonation follows contamination of tissues, the less chance there will be of infection. Four grams of sulfathiazole or sulfadiazine should be given by mouth when the patient is first seen, 2 gm. 2 hours later, and 1 gm. every 4 hours thereafter for 5 days.

At the first dressing of the wound, when its character and disposition are ascertained, mask and gloves should be worn and aseptic technic with sterile instruments should be followed whenever possible.

[1] These suggestions and observations have evolved from experience at the Mare Island Naval Hospital and from surgical conferences attended by the author while stationed at Naval Base Hospital No. 3, South Pacific, and while assigned as surgical consultant to the First Corps Medical Battalion, of the First Marine Amphibious Corps. Participants and contributors at these conferences were Capt. J. W. Ellis (MC) U. S. N.; Col. Ashley Oughterson (MC) A. U. S.; Lt. Col. W. J. Potts (MC) A. U. S.; Commanders T. E. Reynolds (MC) U. S. N. R., and R. G. Jacobs (MC) U. S. N. R.; Maj. H. A. Sofield (MC) A. U. S.; Lt. Comdrs. W. L. Rogers (MC) U. S. N. R.; D. B. Williams (MC) U. S. N. R.; and Hannibal Hamlin (MC) U. S. N. R.; and Lt. N. B. Pavletic (MC) U. S. N. R.

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The introduction of new organisms after the initial injury should be avoided at all times. If a mask is not worn, as on the field, the mouth should be directed away from the wound when speaking.

The immediate treatment of a wound depends on elapsed time from injury, and on the character of the wound, whether still in a state of contamination or in a state of infection. The state of contamination has generally been considered as limited to the first 6 hours after injury, but the early, liberal, and effective use of the sulfonamides can prolong this period many hours. When the wound is in the state of contamination, cleanse wound thoroughly with copious amounts of sterile saline solution or boiled water. When suction is available, use tonsil sucker or large catheter inserted deeply into the wound, as this is a most effective method of removing infected blood clot, debris, and bacteria from the depths of the wound. Remove all loose bodies, bits of clothing, any foreign material, and unattached bone.

Do not *excise* wound. Do a "cleansing debridement" with sharp scissors, removing only obviously devitalized, badly traumatized tissue. Tie bleeders. Avoid tight packing of wound with gauze to control bleeding. If bleeding is due to tangential wound of large artery, ligate above and below the wound, and divide at the site of injury. If a badly contused artery gives evidence of early rupture, ligate above and below the wound, and divide. Ligation and division reduces the possibility of secondary hemorrhage by permitting retraction of the ligated ends. If the main artery to a limb requires ligation, ligate also the accompanying vein. The early development of a continuous thrill and bruit in a wound is indicative of an arteriovenous fistula. Do not operate hastily upon such a lesion. If absence of infection and decrease in local swelling permit, defer operation for 4 to 6 months to await complete disappearance of the swelling. Then danger of infection is minimal and the development of an adequate collateral circulation is completed.

If a nerve is divided, with or without loss of substance, approximate the ends as closely as feasible with several black silk or fine steel wire sutures applied in the perineural tissues. Apply plaster cast with the nerve in maximum position of relaxation by flexion of adjacent joints. This position is to be retained for 2½ to 3 weeks. A secondary operation may be necessary 6 to 8 months later because of failure of nerve union due to infection or to loss of substance. The subsequent approximation of nerve ends however will be much more readily accomplished if the above precautions are carried out.

After cleansing debridement, rewash the wound well with saline solution or water, and apply sulfonamide power containing equal parts of sulfanilamide and sulfathiazole liberally to every possible

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portion of the wound. Spraying or "dusting" the exposed surfaces is not adequate. Make an emulsion in the wound by mixing the sulfa powder with tissue serum and blood, and smear this emulsion into every crevice of the wound with the gloved finger or with an instrument. If the wound is deep and the location makes it possible, make a counter incision in a nonvital area opposite the wound of entrance, and pull gauze heavily impregnated with sulfa power through it. Never leave gauze or a tube in the wound as a through-and-through drain. Instead, introduce vaseline strips into each opening to the depth of the wound; these can then be spontaneously extruded as healing occurs. If possible, all raw and exposed surfaces of bone should receive a coating of the sulfonamide emulsion.

Introduce gauze strips thoroughly impregnated with vaseline or 5-percent sulfathiazole ointment, into the depth of the wound and likewise cover the side walls of the cavity. Do not pack the wound tightly. Fill in the space between the walls of the cavity with bulk vaseline or ointment. Cover the wound with gauze—not too amply—apply sheet cotton, or sheet wadding, and enclose in a plaster dressing. Use one layer of sheet wadding over the entire limb, two layers over bony prominences, and protect the heel adequately. Do not use skin-tight casts. Avoid voluminous dressings such as bulk cotton over wounded area, as this permits edema and herniation of raw tissues beyond the surface of the skin. Do not cut window in casts. Do not dress wound after cleansing debridement unless fever, broken cast, poor reduction of fracture, or excessive soiling of cast demand it. Include thin metal strips, thin wooden strips, or basswood splints soaked in water, to strengthen the cast at points of stress, and to conserve plaster.

Gunshot wounds of the extremities that shatter the bone usually have a paralyzing effect upon the surrounding muscles. Hence reduction is surprisingly easily accomplished without much manipulation and with moderate traction by simply alining the normal control points; big toe, patella, and anterior superior spine, and applying a plaster cast. Avoid unnecessary motion at site of fracture during application of cast by first applying a fairly heavy posterior splint of plaster, mold this to limb in position of reduction, permit it to harden, and then apply circular plaster bandages.

Avoid separation of fragments through excessive traction. This is important also in the application of Thomas splints in the field. The object of these splints should be immobilization, not primarily reduction.

Avoid overtight clove hitch traction to the bare or booted foot. Subsequent amputation has been found necessary because of gangrene precipitated by a clove hitch too tightly applied and subjected to excessive traction in the field where continuous observation is impossible.

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While casts applied to elbow and forearm, or to thigh and lower leg, are still wet, split them down the center anteriorly, cutting the plaster down to the sheet wadding or stockinette. If evidence of circulatory embarrassment appears, such as cyanosis, swelling, coldness or numbness of the toes or fingers, immediately spread the cut edges of the cast even more widely, and divide all material down to the skin. Failure to heed these signs leads to gangrene or Volkmann's ischemic contracture.

When plaster dressing has been completed, indicate the site and size of the wound and draw a picture of the fracture on the cast with indelible pencil. Indicate also division of nerve or tendons, or major artery when present. State date of application of the cast.

Splint or immobilize with plaster all extensive injuries to soft parts even in absence of fracture of the bone. Injuries to soft parts around the shoulder should be dressed with arm well elevated, the arm to be held in this position by shoulder spica or by airplane splint. This prevents disabling contractures of axillary tissues.

Never close a wound completely. Generally speaking, all wounds are better left widely open except wounds of the face. Exposed joint surfaces and exposed tendons should be covered by skin flaps whenever possible, after thorough cleansing and sulfonization.

All amputations should be guillotine in type. All viable skin and bone should be saved. No sutures are necessary nor are they desirable. Apply sulfonamide powder liberally to the bone, and to the site of ligation of vessels. Introduce one vaseline strip down to, but not touching, the bone end, and cover raw surfaces with vaseline or sulfathiazole ointment gauze.

Never apply dressing to amputation stump with stump *elevated*, rather apply dressings and bandage or cast to the stump with the affected arm or leg hanging over side of table in a dependent position. Gravity pulls muscle and skin over the bone stump, and when bandaged in this position, the maximum covering of the bone is attained. Immobilize in extension by a plaster dressing the joint proximal to the amputation. Apply a posterior molded splint of plaster so as to project beyond the end of the stump about 2½ to 3 inches. Let this harden and apply circular plaster bandages. Apply hip spica for thigh amputations with the head of the table elevated to make stump dependent. If the cast cannot be employed immediately, do not permit a thigh amputation stump to be elevated on pillows; this pulls the adjacent soft tissues away from the end of the bone. A thigh stump should lie flat on the bed, and the head of the bed should be elevated on blocks to permit the soft tissues to fall over the bone end. This will permit gravity traction during the period before skin traction can be applied.

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Plaster immobilization of an amputation stump with proximal joint in extension will prevent: (*a*) Trauma to stump; (*b*) infection; (*c*) possible secondary hemorrhage; (*d*) flexion contractures. After application of cast do not dress the stump unless fever or definite indications demand it. Patient should be made ambulatory, on crutches if necessary, as soon as his general condition permits. After 2 to 3 weeks, remove cast and apply skin traction. Adhesive strips applied to the skin on four sides of the stump should project well beyond the end of the stump in order to permit fashioning from them a small well in which weights may be carried to maintain constant traction even though the patient is ambulatory.

Gas gangrene.—The mere presence of gas bubbles in tissue as demonstrated by roentgenograms is not evidence of gas bacillus infection. They may be due to air carried in by the projectile, or due to nonpathogenic gas-producing organisms. True gas gangrene is a rapidly progressive, spreading infection, characterized by abrupt rise in temperature, rapid pulse, severe toxicity, severe local pain and tenderness, mouse-like odor, bronze discoloration of skin, and crepitus. If diagnosis is established by clinical evidence and by study of smears from the wound: (1) Give double therapeutic doses of polyvalent gas gangrene antisera intravenously; (2) give full dosage of a sulfonamide, by mouth, or intravenously, or by rectum; (3) excise wound widely and completely, removing all necrotic tissue and foreign bodies, and excise completely any muscle that shows evidence of being partially devitalized; (4) apply liberally local sulfonamides; (5) obtain wide-open drainage with vaseline strips, and (6) immobilize. Amputate only if infection is spreading rapidly, or if blood supply to extremity is obviously badly impaired.

When a wound is first seen in a state of positive infection, operative treatment must be limited to removal of detritus and foreign bodies. If possible do not produce bleeding in the wound, do not irrigate, do not break down the natural defense barriers set up by the body, by rough handling of tissues, by excessive exploration of wound, or by unnecessary manipulation of the wounded parts. Remove foreign material, introduce sulfonamides and vaseline strips to all pockets of the wound and immobilize in plaster whether fracture of the bone is present or not. Provide sulfonamides by mouth, and do not dress wound unless positively indicated by persistent fever, pain, or failure to improve.

A badly infected joint is a serious menace to life, particularly an infection of the knee joint that begins to spread upward in the muscle planes of the thigh. A septic knee joint may be more adequately drained by removal of the patella. If a septic knee is accompanied by a well advanced general sepsis, an early thigh amputation is necessary to save life.

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Causalgia, a severe, persistent, neuralgic-like pain producing an apprehensive, sick patient with red, shiny skin and atrophy of the affected part of the extremity, is a frequent complication of peripheral injuries, most probably due to involvement of the sympathetic nervous system, reflexly or directly. Repeated paravertebral injections with novocain of the lumbar sympathetics in lesions of the lower extremity, and of the inferior cervical and superior thoracic ganglia in lesions of the upper extremity, are most effective in allaying this agonizing pain.

Foreign bodies.—Accessible bullet and shrapnel fragments should be removed at the time of cleansing debridement. If a foreign body lies far remote from the immediate wound, a second incision for its removal may be necessary but should be deferred until later, unless it lies very superficially. Foreign bodies in constantly moving tissues such as a joint capsule, or if imbedded among tendons, as at the wrist, or in the movable structures of the neck, or if located in perineural tissues, should be removed early to avoid disabling fibrosis and distal paralysis by fibrous constriction of the nerve. Jagged foreign bodies lying near large vessels should be removed early to avoid danger of erosion by motion or by infection. Great care must be exercised in withdrawing a jagged sharp foreign body along a path in which important structures such as main vessels and nerves lie. A second incision permitting withdrawal in the opposite direction is preferable.

To avoid subsequent embarrassment at the operating table, the surgeon who expects to remove a foreign body should be present at the fluoroscopy undertaken to determine exactly the intersection of the three planes in which the foreign body lies, these planes to be clearly marked on the skin with the body in the position to be assumed later on the operating table.

Burns.—The use of massive plasma infusions and salt solution by vein is axiomatic. Avoid tannic acid or any escharotic agents. Apply a thin coating of sulfonamide powder by spray. Apply gauze heavily impregnated with vaseline, or 5-percent sulfathiazole ointment, cover this ointment gauze with oiled paper to prevent absorption of the ointment by overlying dressings, apply fairly voluminous dressings and a pressure bandage. Do not disturb for 10 days unless fever demands it. Begin a sulfonamide immediately by mouth. If the patient is vomiting give the sulfonamide intravenously, or by rectum (4 gm. sulfanilamide emulsified in 100 cc. of water introduced by catheter into rectum every 8 hours).

All dressings for burns must be applied with joints in full extension to avoid skin contractures. However, a badly burned hand should be supported in the neutral position of moderate flexion of fingers and slight dorsiflexion of wrist. In burns involving the axilla, it is most important to apply vaseline gauze, oiled paper, and bandage with arm

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well elevated. Only after this precaution may the arm be brought to the side of the body.

When the patient is no longer in transit, and has reached a hospital where continuous care can be administered, the repeated frequent application of paraffin wax by spray is the least painful and a most efficacious treatment for burns.

Thoracic wounds.—Immediate marked dyspnea in the presence of a nonsucking wound of the thorax is probably due to pressure pneumothorax or to hemothorax. If signs point to pneumothorax, put in a needle and withdraw air; if air reaccumulates promptly, leave the needle in place, attach a rubber tubing, and place the other end under water. If subcutaneous emphysema appears in the neck above the suprasternal notch in the presence of marked respiratory embarrassment, a mediastinal emphysema is probably present. A short incision in the suprasternal notch will permit the escape of air, and may be life-saving.

A hemothorax should be aspirated—*without* replacement with air—only if dyspnea or mediastinal shift demand it. If hemothorax or evidence of effusion persists 2 to 3 weeks, partial aspiration—*without* replacement with air—is indicated. When possible study the aspirated fluid by culture and by determining red cell, white cell, and hemoglobin content. When repeated aspirations are found necessary, comparison of these studies will yield important information as to future care.

Jagged wounds of the thoracic wall should be well debrided, liberally treated with sulfonamide powder and loosely closed to avoid infection which may extend to an underlying hemothorax with disastrous results.

Sucking wounds must be closed immediately. If operation is not possible, cover wound with a sterile glove or sterile cellophane, or gauze heavily impregnated with vaseline or with 5-percent sulfathiazole ointment. A pad is then applied and fixed in place with adhesive straps completely encircling the chest. The operative closure of a sucking wound may require semilunar incisions in muscle, or if muscle is not available, semilunar incisions in the skin, enabling it to be drawn over the defect, the resulting raw surfaces subsequently to be epithelized by skin-grafting.

Abdominal wounds.—Immediate operation is indicated in any perforating wound of the anterior abdominal wall, whether evidence of peritonitis exists or not. Operate through an incision independent of the wound. Debridement of the traumatic wound is to be done at the end of the operation. Wounds involving the mesocolon or mesentery of the small bowel, producing large retroperitoneal extravasations of blood in presence of a perforating wound of the bowel are particu-

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larly dangerous to life from subsequent peritonitis. Under these conditions a Mikulicz procedure is indicated when feasible. When this is not possible as in the distal pelvic colon or rectum, a complete colostomy proximal to the repaired area is absolutely necessary. Simple perforations of the bowel without retroperitoneal extravasations may be closed by suture without the performance of a colostomy. Continuous gastric suction by in-dwelling Levine tube should be immediately provided in all abdominal wounds.

Large wounds of the liver, following careful cleansing and sulfonamide application, must be drained, preferably through a separate stab wound. Oozing may be controlled by applying to bleeding points, muscle fragments obtained from the incision in the abdominal wall.

Urinary extravasations are exceedingly dangerous to life. If bladder or urethral injuries are suspected as evidenced by hematuria, absence of urine, lower abdominal tenderness and swelling, immediate suprapubic cystostomy for urinary drainage is absolutely indicated.

Head injuries.—Wounds of the face require cleansing with soap and copious amounts of water, minimal debridement with conservation of all skin and tissue possible, liberal sulfonamide application and accurate approximation of skin edges. Jagged wounds of the cheek with loss of considerable substance should not be closed under tension. It is preferable to approximate mucous membrane to skin along line of laceration, leaving open defects into the mouth, which can be closed later by plastic revision.

Do not remove any fragments of the lower jaw still attached to the periosteum or to surrounding tissues. Maintenance of contour of jaw during the healing process is most necessary .

Frontline treatment of head injuries without laceration of scalp consists of rest in recumbent postion, and as little and as gentle transportation as possible. Do not give morphine unless other associated injuries demand it. If bloody fluid is leaking from an ear, plug lightly with cotton. Record briefly the neurologic examination; size and equality of pupils, facial symmetry, right and left muscular or sensory disturbance, and presence or absence of superficial and deep reflexes.

Lacerations of scalp.—Determine if skull is intact by inspection. or palpation with gloved finger or sterile instrument. Shave the surrounding area if possible. Cleanse thoroughly but gently. Perform minimal debridement of obviously nonviable tissue. Frost lightly with a sulfonamide powder. Approximate wound edges with adhesive strips or with not more than two or three loose sutures. Apply a secure dressing. If uncertain about integrity of skull, leave the wound open.

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Penetrating wounds and compound skull injuries are treated in the same general way but are always left open. Optimum time for definitive treatment is dependent upon availability of adequate surgical and radiologic equipment. Be careful in moving large or depressed pieces of bone or metallic fragments. They may tampon large vessels. If foreign bodies do not lift out easily leave them alone. Do not poke or scrape around exposed brain. Do not use strong antiseptics such as tinctures or alcohol. Cleanse gently with soap and water. Frost exposed brain with sulfanilamide; not sulfathiazole as it produces fibrosis. Apply vaseline gauze and a dressing that will stay on. Elevate head of cot or stretcher. Begin systemic sulfonamide at once, by mouth if possible, otherwise by vein, or by rectum.

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PENICILLIN AS A CHEMOTHERAPEUTIC AGENT

Pencillin is a chemotherapeutic agent exhibiting a remarkable antibacterial action against gram-positive organisms and against gonococci and meningococci. It is not effective against gram-negative bacteria. Its activity is of a totally different order of magnitude from that of any of the sulfonamide compounds. It is effective both in vitro and in vivo and active in the presence of pus and inflammatory exudates. Its action appears to be either bactericidal or bacteriostatic, depending upon the conditions of the experiment.

Penicillin appears to be completely nontoxic in doses far exceeding those necessary for therapeutic purposes and is rapidly excreted through the kidneys. Consequently frequent administration is necessary to maintain an adequate blood concentration.—Dawson, M. H.; Hobby, G. L.; Meyer, K.; and Chaffee, E.: Penicillin as a chemotherapeutic agent. Ann. Int. Med. 19: 716, November 1943.

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EFFECTS OF DRINKING SEA-WATER

The effects of drinking up to 400 cc. of sea-water daily, when either totally or partially deprived of fresh water, and on the low-calorie low-salt diet of the "man on the raft" may be summarized as follows:

An increase in urine output, with an improved total urea-clearance.

A slight gain to the body of water, because the extra water lost in the urine is less than the extra water ingested as sea-water.

An initial retention of chloride equal to the chloride lost before beginning to drink the sea-water; and subsequently full excretion of all the chloride ingested.—Ladell, W. S. S.: Effects of drinking small quantities of sea-water; an experimental study. Lancet 2: 441–444, October 9, 1943.

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THE NORFOLK EXPLOSION DISASTER

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and

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On 17 September 1943, a number of bombs accidentally exploded as they were being towed along a ramp at the Norfolk Naval Air Station, Norfolk, Va. The force of the explosion was sufficient to demolish completely 6 buildings, and to break glass in windows more than 1 mile away. About 400 people were injured, 215 seriously



1. Scene of the blast, a short distance north and east of the dispensary. Note five ambulances scattered throughout. We had, from our activity, eight ambulances, two trucks, and a station wagon at the scene within 5 minutes.

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enough to require hospitalization. Of this latter group 144 were sent to the United States Naval Hospital, Naval Operating Base, Norfolk, Va., and it is with these particular casualties that this report is concerned.

Twenty persons were killed outright by the explosion; several others died within the next few hours. Six weeks after the catastrophe the total was 28.

Of the 144 admitted to this hospital 2 died. The first was a man who had an extensive compound fracture of the right femur with development of gas gangrene. He died on the third day, 8 hours after an amputation. The other death occurred in a man whose femoral and radial arteries had been severed; he died 4½ weeks after the explosion, and 10 days following an amputation of his leg. Both of these cases will be reported upon more fully later in this paper. None of the patients now living is on either the serious or the critical lists. Sixty-four operations have been done on 42 patients. Thirty-nine patients have had 1 operation, 4 have had 2 operations, 3 have had 3 surgical procedures, and 2 have had 4. However, as shown on table 1, it is obvious that many more surgical procedures will have to be done, such as skin-grafting and reconstructive surgery before many of the seriously wounded can be rehabilitated. The problems presented by the victims of the explosion were similar to those seen in battle casualties.

TABLE 1.—*Types of injuries sustained*

	Cases
Compound fracture of leg	14
Compound fracture of femur	1
Compound fracture of skull	2
Compound fracture of zygoma	1
Compound fracture of arm	1
Compound fracture of hand	2
Compound fracture of clavicle	1
Compound fracture of scapula	1
Burns, first and second degree, of the face, eyelids, and eyes	2
Multiple shrapnel wounds (minor)	102
Multiple shrapnel wounds (major)	42
Multiple lacerations of the face, lips, scalp, neck, and shoulders	7
Multiple lacerations of the chest wall	6
Multiple lacerations of the abdominal wall	7
Multiple perforations of the intestine	2
Severed femoral and radial arteries	1
Severed saphenous vein	1
Shrapnel in the lung	1
Perforation of the eardrum (concussion)	18
Blast injuries in those who lived (not counting eardrum perforations)	0
Perforation of the larynx	1
Shrapnel and/or glass in the eye	21
Retroperitoneal hemorrhage	1

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The explosion occurred at 1100 and by 1215 most of our 144 patients had been admitted. Forty-two patients were in shock and they received during the first day a total of 64 bottles (500 cc. @) of wet plasma and 15 bottles (500 cc. @) of whole blood. In addition one patient received 2 transfusions of serum albumin of 100 cc. each. None of the seriously wounded was operated upon during the first 8 hours with the exception of 2 who had compound fractures of the skull, 2 others with very extreme lacerations, and one who was brought in with severed femoral and radial arteries. Both of the laceration cases will be described later. In spite of the fact that each of these had received between 100 and 200 cuts and wounds due to shrapnel, or glass, or both, they maintained good blood pressures. They were operated upon under avertin basal anesthesia supplemented by local anesthesia at certain areas. Both patients having compound fractures of the skull are living and enjoying normal convalescence without any sign of mental aberration or of other abnormal neurologic findings; this in spite of the fact that one had brain tissue on his sleeve when he was brought into the hospital.

Sulfanilamide was used in all wounds following limited debridement. Sulfathiazole and sulfadiazine were administered orally in many cases, and sulfadiazine was introduced intravenously when patients were unable to take anything by mouth.

Immediately after the explosion, the most seriously injured were treated for shock at the naval air station. Some 24 transfusions of plasma were administered by the medical staff there. There is no question that 6 or 8 lives were saved by that plasma. Several patients received very considerable amounts of plasma and blood. For example, case 3 with shrapnel wounds of the face, neck, legs, as well as 8 perforations of the intestine, received 3,500 cc. of blood and plasma the first day, in addition to 800 cc. of 5-percent dextrose in saline. He received 1,000 cc. of plasma at the naval air station, 500 cc. of plasma and 500 cc. of blood before operation here, another 500 cc. of blood in the operating room, and another 500 cc. of blood postoperatively. He was not operated upon until 8 hours after admission, at which time his blood pressure was 110/62.

Another patient had received multiple injuries, including compound fractures of skull and leg. He was given 1,000 cc. of plasma at the naval air station, no plasma in the operating room, and two 100-cc. transfusions of serum albumin postoperatively. He also received 500 cc. of lyophilized plasma on the following day. On the first day, surgery was limited to a debridement and closure of his brain and skull wound. The leg was not touched until the third day, when Steinmann pins were inserted above and below a very severe comminuted compound fracture of his right tibia. The brain surgery was

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done under intravenous sodium pentothal anesthesia, and the operation on the tibia under spinal anesthesia. This patient is living and well today, but it will be necessary, after the leg wound has healed, to do some type of bone grafting, as a large portion of the tibia was destroyed. Serum albumin was used in this instance (following his first operation), in an endeavor to prevent too great an increase in blood pressure and still maintain a sufficiency of circulating fluids. Two hundred cubic centimeters of serum albumin is equivalent in its restorative ability to 1,000 cc. of plasma, due to its much greater osmotic tension. The patient's blood pressure was maintained at the lower limits of normal, without having to introduce into his blood stream too great an amount of fluid; consequently the dangers of too great an increase in intracranial pressure and hemorrhage would be minimized.

Sixty-three hundred cubic centimeters of blood and plasma were administered during the first 24 hours to the patient (case 1) whose femoral and radial arteries had been severed by shrapnel. He received 1,000 cc. of plasma at the naval air station, 500 cc. of plasma preoperatively here, 2,350 cc. of blood in the operating room, and another 2,450 cc. of blood and plasma postoperatively. This case will be abstracted later, but the point we should like to emphasize here is that although the patient had two large arteries completely severed and was in advanced shock, his life was saved at least temporarily by plasma. His leg had to be amputated 3 weeks after admission; he died 10 days following that operation.

TABLE 2.—*Surgical procedures during the first 6 weeks*

	Cases
Amputation of the leg	4
Enucleation of the eye	2
Suturing of multiple perforations of the intestine	2
Winett Orr technic in the treatment of compound fractures	14
Haynes splints applied during the first 6 weeks	6
Steinmann pins applied for compound fracture of leg	1
Kirschner wire applied for compound fracture of leg	4
Ligation of femoral and radial arteries	1
Ligation of the saphenous vein	1
Debridement of compound fracture of the skull with primary brain suture	2
Amputation of the fingers	2
Removal of shrapnel from various parts of the body	129
Removed with aid of fluoroscope	20
Removed with aid of Berman locator	6
Suturing of severe lacerations of the face, eyelids, forehead, nose, lips, and neck	6
Tracheotomy	1
Laparotomy for retroperitoneal hemorrhage	1
Changes of casts on leg	29

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It is interesting to note that 11 of the 22 operations done on the first day were done under spinal anesthesia, a circumstance which would not have been possible without plasma. However dosages of spinal drugs were kept at a minimum, depending upon the surgery indicated. For example an amputation of a leg was done with the use of 110 mg. of procaine and dextrose, and both cases of multiple perforation of the intestines with 14 mg. of pontocaine and dextrose. With one of the latter, curare (intocostrin) was used as the peritoneum was being closed. The patient had been under anesthesia for 75 minutes and there was considerable rigidity which made it difficult to replace the intestines within the peritoneal cavity, and made closure of the wound difficult if not impossible. Within 1½ minutes after 60 units (3 cc.) of intocostrin had been administered intravenously, there was relaxation which lasted for more than 20 minutes. We did not see any change in respiration which we thought might be attributed to curare. The patient was under a sleeping dose of pentothal at the time that the intocostrin was administered.

TABLE 3.—*Types of anesthesia*

	Cases
Spinal anesthesia (pontocaine and dextrose)	13
Spinal anesthesia (procaine and dextrose)	5
Spinal anesthesia (procaine and dextrose) plus pentothal sodium intravenously	2
Spinal anesthesia (pontocaine and dextrose) plus pentothal sodium intravenously	6
Spinal anesthesia (continuous technic) plus pentothal sodium intravenously	1
Avertin with amylene hydrate (rectally)	3
Nitrous oxide and oxygen	2
Nitrous oxide and oxygen and ether	3
Cyclopropane and oxygen and helium	1
Brachial plexus block anesthesia	2
Pentothal sodium intravenously (alone)	15
Pentothal sodium supplementing spinal	9
Local anesthesia	10
Refrigeration anesthesia (ice)	1
Intravenous morphine	2
Continuous oxygen throughout anesthesia	21
Curare (intocostrin)	1

Eighteen of the twenty-two patients operated upon the first day received continuous oxygen, either by mask, endotracheally, or by intranasal pharyngeal catheterization. All patients who were given pentothal sodium also had continuous oxygen. Pentothal sodium was given in small amounts to several patients who were under spinal anesthesia, not for its anesthetic value but merely to put the patient

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asleep. Many of these patients were in an extremely excited and nervous state due to the experience which they had just undergone, and we are quite sure that the administration of pentothal intravenously for this reason was of special value. Pentothal was used 10 times the first day, and 2 extensive laceration cases received no other anesthesia. It has been our experience that pentothal may be administered in moderate shock with as much and probably more safety than any other anesthetic agent. Reports confirming this opinion are now coming in abundantly from various battle fronts.

Sixty percent of the surgical cases operated upon during the first day received continuous oxygen after returning to their wards, administered either by the B–L–B masks (with large G tank) or by means of an oxygen tent. Oxygen and helium was given to four patients on the operating table.

Although we had a large amount of intravenous equipment, it was all used up within 2 hours. New equipment was broken out and sterilized, and teams, whose duty it was to see that all returning intravenous material was cleaned and sent through the sterilizer without delay, were assigned to the central dressing room. We had only one severe reaction to plasma, which may or may not have been due to faulty technic in cleaning the rubber tubes and other intravenous gear. The patient had received two complete 500-cc. transfusions of plasma and was just beginning the third when he began to have violent chills. Intravenous morphine was given, but the chills continued for another 55 minutes. In spite of the reaction the patient made a satisfactory recovery.

TABLE 4.—*Use of plasma and blood (first 3 weeks)*

	Cases
500-cc. bottles of wet plasma used on 42 patients on the first day	64
100-cc. transfusions of serum albumin	2
500-cc. transfusions of wet plasma during first 3 weeks, in addition to that used on the first day	127
Total number of bottles of plasma used during the first 3 weeks	193
500-cc. transfusions of whole blood on the first day	15
500-cc. transfusions of whole blood during the following 3 weeks, in addition	37
Total number of bottles of whole blood administered during the first 3 weeks	52
Total number of bottles of plasma and of blood used during the first 3 weeks	245

The elective removal of foreign bodies was undertaken only in those cases in which the foreign body was producing symptoms. The one exception was a case where there was a large jagged metallic foreign body in the pelvis, lying directly over the right ureter.

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The Berman locator proved to be of great aid in the localizing and removal of metallic foreign bodies. To date it has been used six times with good results. These six cases were all considered to be difficult ones. The locator would have been used many more times had it been available during the first 4 weeks.

CASE REPORTS

Case 1.—Laceration of femoral and radial arteries.—This man had extensive injuries to the right thigh, involving the femoral artery, and to the right arm, involving the radial artery. In spite of the fact that he received large quantities of blood and plasma, both at the naval air station and here, his pulse could not be brought lower than 160 until several hours after surgery.

The first operation consisted in ligation of the cut arteries, cyclopropane being used for anesthesia. Threatened gangrene of the leg was treated by refrigeration for 12 days. Paravertebral novocain block was done, which was followed by severe shock having the characteristics of a novocain reaction. Two days following this episode he had another reaction to novocain when a small skin wheal was raised with novocain in preparation for a transfusion of blood. He received 6,300 cc. of blood and plasma on the first day, followed by three transfusions of plasma and nine transfusions of blood in the next 4½ weeks. Three weeks after the original injury his right leg was amputated for dry gangrene under refrigeration anesthesia. Seven days later hematuria developed which was followed by anuria and jaundice. We were unable to determine whether the renal suppression was due to a transfusion reaction, to crush syndrome, or to some unknown toxic factor.

The patient was typed for the Rh factor and found to be Rh positive; this finding was obtained by our laboratory here and was corroborated by Dr. A. S. Wiener of Brooklyn, N. Y. Therefore a hemolytic transfusion reaction on the basis of Rh iso-immunization was ruled out. The result of the studies submitted by Dr. Wiener on the Rh factor are as follows:

Blood	Group	M-N type	Rh type
Patient	B	MN	Rh_1.
Carney (donor)	B	MN	Negative.
Duarte (donor)	B	MN	Rh_1, Rh_2.

The urinary suppression was relieved by an abundance of Ringer's solution with sodium lactate and digitalis. The patient showed evidence of dilatation of the heart and there was marked gallop rhythm. Death occurred on the 10th day after amputation, with edema of the lungs and cardiac failure.

Case 2.—Compound fracture of the right femur and left scapula.—This patient had an extensive compound fracture involving the right femur, the left scapula, and possibly an intracranial injury. He was treated for shock, and on the first day he received 5,500 cc. of plasma and blood, 1,500 at the naval air station, and 4,000 here. The scapular wound was flushed with saline and treated with sulfanilamide powder, and then covered with vaseline dressings. No anesthesia was required. There was definite evidence of impaired circulation below the knee. Under local anesthesia a Kirschner wire was inserted through the proximal end of the right tibia and balanced skeletal traction was applied. Following application of traction there was little or no improvement in the color and temperature of the lower leg, and 48 hours later there was definite evidence of gas gangrene of the leg.

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Polyvalent gas gangrene antitoxin was administered in large quantity, and a guillotine amputation was done through the lower end of the femur, under low spinal anesthesia. The patient was given blood and plasma during and after the operation as well as continuous oxygen, but he died 8 hours later.

Cases 3 and 4.—Multiple perforations of the intestine.—Both of these patients were admitted in advanced shock, with multiple perforations of the intestine. One had a compound fracture of the foot, and the other had a compound fracture of the arm in addition to his intestinal injuries. The first was operated upon 8 hours after admission, the second 10 hours after admission. The first had 8 perforations of the small intestine, while the second had 12 perforations, some in the small and some in the large intestine. At operation a jagged metallic foreign body was found within the peritoneal cavity in each case. No other abdominal viscera were injured in either patient. The perforations were closed with catgut, and 8 gm. of sulfanilamide crystals were placed in the peritoneal cavity in each instance. Postoperatively both were treated with Wangensteen drainage, and both received 5 gm. of sulfadiazine intravenously for the first 4 days after surgery. Both made a satisfactory recovery.

Case 5.—Laceration of right groin and saphenous vein.—This patient had a most severe hemorrhage following injury to the right saphenous vein by shrapnel, for which he was given 4,500 cc. of blood and plasma on the day of admission. One thousand cubic centimeters of this plasma had been given at the naval air station. He was not operated upon, and hemorrhage was controlled by pressure vaseline dressings, together with elevation of the foot of the bed. He later developed a phlebitis involving the thigh, but in spite of this, the condition of his leg was good. Several days later, an arterial block occurred at the bifurcation of the popliteal artery, and following this the circulation in the foot was greatly impaired. The lower extremity was then refrigerated for 12 days, but in spite of this dry gangrene developed in the foot. Five weeks after admission a formal amputation with anterior and posterior flaps was done, with primary closure. The amputation was done 8 inches below the knee. The stump healed by primary union.

Case 6.—Perforation of the larynx with traumatic cataract of the eyes.—This patient received a perforating wound of the larynx which penetrated the cricothyroid membrane. When he reached the hospital he had a tracheotomy tube in his larynx, which unquestionably saved his life. In addition to the injury to his larynx there was also an extensive laceration of both eyelids and of the face and neck. The patient developed acute bronchitis and expectorated thick mucus through the tube. An elective tracheotomy was then done. At present, the lumen of the larynx is less than one-half of normal, but the lacerated area has practically healed. Slow and tedious dilatation of the larynx will have to be undertaken.

He now has traumatic cataracts in both eyes with practically no vision in the left eye, and only about two-thirds vision in the right. The eyes will be operated upon at a later date. The prognosis for return of normal function of his larynx is not good.

Case 7.—Multiple lacerations of the face and eyes.—This man was sitting at his desk in a building near the scene of the explosion. At the sound of the first and smaller explosion he arose, and stood at the window. Just then, the second and far greater explosion occurred, and he was knocked to the deck. He received literally hundreds of cuts from flying glass, especially on the face, neck, arms, head, and in his eyes. On arrival he had already received 1,000 cc. of plasma, and another 500 cc. was administered to him in the operating room.

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Under avertin anesthesia, enucleation of the left eye was done, as it was too far damaged to be saved. Several pieces of glass were removed from the right one, in which a prolapse of the cornea involving the ciliary body was found. A small amount of vitreous fluid escaped. The wound was sutured and a conjunctival flap was placed over it. Following operation he was given a transfusion of whole blood.

At the present time the patient's general condition is good, and he will shortly be ready for operative repair of a retinal detachment.

Case 8.—Multiple lacerations of the face and eyes.—This patient was admitted in moderate shock with many very severe and extensive lacerations involving the face, eyes, neck, shoulders, breasts, and chest wall. Numerous pieces of glass were removed from both conjuctival cul-de-sacs and from beneath the bulbar conjunctiva of both eyes. The interior of the right eye could not be seen, but there was no evidence of perforation of the globe.

Under avertin anesthesia more than 100 cuts were sutured. A prolapse of the iris of the left eye was excised, and a purse string used to close a conjunctival flap over the cornea. Atropine and 5-percent sulfathiazole ointment were instilled into each eye, and sulfadiazine was administered by mouth. In the next several days numerous pieces of glass were removed from both eyes, the conjunctival flap was loosened on the 6th day and it receded to the limbus.

Ten days after the explosion eight large pieces of glass were removed from the breasts, neck, and arms, the procedure being done under local anesthesia. At discharge the right eye was negative except for several small corneal scars which were not in the visual axis. The left eye still had many pieces of glass embedded in the cornea and in the lower anterior chamber. There was a healed corneal laceration with synechia and iris coloboma laterally, together with a posterior subcapsular lens opacity.

CONCLUSIONS

Plasma and blood transfusions undoubtedly saved many lives. The use of plasma before, during, and after surgery, and of blood during and after surgery, enabled many patients to go through operative procedures which otherwise might not have been possible.

The small number of postoperative infections and traumatic wound infections was due to the use of the sulfa compounds both locally and systemically.

A number of different anesthetic agents were used, depending upon the requirements of the individual cases.

The Berman locator was used with good results.

The prompt and efficient work of the medical staffs of the naval air station and naval training station in administering plasma and sulfanilamide, in securing tourniquets, and in the management of fractures and of other first-aid problems unquestionably saved many limbs and lives.

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FACTORS PRODUCING OBSTRUCTION OF THE AUDITORY TUBE IN SUBMARINE PERSONNEL

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An important item in the instruction of submarine personnel is training in the use of the escape device. This involves exposure to 50 pounds of air pressure as a preliminary test; next, two escapes from the diving bell at 12 feet, and finally, two from the 18-foot lock of the training tank, using the escape device. Optionally they may also complete two escapes from the 50-foot lock and two from the 100-foot lock. The most common difficulty encountered in these tests is inability to equalize pressure in the ears due to obstruction of the eustachian tubes.

In certain instances pain is noted in the sinus area for the same reason—the inability to equalize pressure in the sinuses. Toothache is occasionally noted, the usual cause being a leaky filling. Psychologic difficulties are sometimes encountered and usually mark the individual as unfit for the submarine service. In the present discussion only the first condition mentioned will be considered.

In order to learn more about the factors causing obstruction of the eustachian tube in these men an investigation was carried out on four aspects of the subject.

1. The records of the training tank for a period of 1 year were reviewed to provide a basis of comparison and to determine the effect that weather might have on the condition.
2. One group of several hundred men was examined immediately after completing the tests.
3. In another group, routine ear, nose, and throat examinations were made both before and after the tests to determine the effect of various existing conditions in the nose and throat on the eustachian tube and ear.
4. The effect of various types of treatment on the patency of the tube was studied.

REVIEW OF TRAINING TANK RECORDS

Between 1 October 1941 and 1 October 1942, 5,110 men were given the routine tank tests. Of these, 271 were classed as failures because of inability to ventilate the ears spontaneously. Of this number, 147 were passed on a second, third, or fourth attempt. The remaining 124

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were disqualified, the total of those finally disqualified being 2.4 percent of the whole group.

The findings on the effects of weather on ear conditions are shown in table 1. The year was arbitrarily divided into two seasons, the period from 1 May to 1 October being designated as the warm season and the remainder of the year as the cold season.

TABLE 1.—*Seasonal comparison*

	Total	Passed	Failed	Percent
Cold weather group	2,501	2,335	166	6.6
Warm weather group	2,609	2,504	105	4

A difference of 2.6 percent appears to be statistically significant. It indicates that weather does play some role in influencing the factors responsible for obstruction of the eustachian tube. This is probably related to the greater number of upper respiratory infections during the cold season.

OTOSCOPIC FINDINGS AFTER COMPLETION OF TEST

The criterion for failing to pass the tank tests has been ear pain. During the period covered by this study many with tympanic perforations, hemotympanum and similar conditions passed, while others who failed were found to have minimal changes in the ear. It became evident that fear, anxiety, or a low pain threshold might lead to a loud complaint of pain, with very slight or no apparent changes in the ear. On the other hand a phlegmatic personality, great desire to pass the test, or fear of being considered a coward might cause lack of expression of even severe pain while actual otopathology exists.

It therefore seemed desirable to carry out routine otoscopy on a group of trainees in order to evaluate the adequacy of pain as a criterion and to ascertain the extent of ear damage. Accordingly, 708 men were examined otoscopically immediately after they had completed the various tank tests. No changes were made in the manner of selecting the men, of making the tests, or of adjudging failures. Ears were graded as follows: Grade 0, normal; grade 1, retraction with redness in Shrapnell's membrane and along the manubrium; grade 2, retraction with redness of the entire myringa; grade 3, same as grade 2 plus evidence of fluid in the tympanum; grade 4, hemotympanum, perforation of the myringa, or both.

Hearing loss was encountered in all grades except grade 0, as was also noted by Shilling and Everley (*1*). In both grades 1 and 2, the hearing is restored within a few hours, but in grades 3 and 4, weeks or even months may be required for recovery. In a few,

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hearing loss has been permanent. Shilling and Everley, and Campbell and Hargreaves (*2*) considered this loss of hearing as of the conduction type, but in some patients in this series, it was of the higher frequency, perception type. This was also the finding of Simpson (*3*). Tinnitus was mentioned by many of the men, but usually disappeared within a few days.

In addition to evidence of pathologic changes in the middle and inner ears, there was frequent evidence of damage in the external canal. The mildest form was a marked vascular congestion of the skin of the canal, most noticeable at the fundus. In more advanced cases there was hemorrhage, either into the lumen of the canal or forming a subcutaneous or intracutaneous hematoma. Small hemorrhagic blebs were occasionally seen on the myringa, and appeared to be due to a dissection of the layers of the membrane by extravasated blood. In a few cases these blebs ruptured and provided the only visible source of bleeding within the external canal. This would seem to indicate, as Shilling and Everley pointed out, that hemorrhage from the ear is not necessarily a criterion of tympanal perforation. In some instances, blood appeared to have burrowed from the tympanum underneath the attachment of the myringa to form a subcutaneous hematoma in the canal. These were never opened and none became infected.

PHYSIOLOGIC MECHANISM OF CHANGES

Close observation of these patients tended to indicate that at least 4 factors are responsible for the pathologic changes noted:

1. Negative pressure in the tympanum and tube.
2. Expansion of the blood vessels.
3. Vascular paresis.
4. Rupture of either myringa or blood vessels, or both.

If a person who cannot inflate his eustachian tubes were to be placed in a pressure chamber and the air pressure increased 2 pounds, a negative pressure, or vacuum, of 2 pounds in the tubotympanum would occur since equalization cannot take place. The result is the same as if a suction pump had been applied to the tubal ostium and a vacuum of 2 pounds created. The blood vessels of the tubotympanum, moreover, are under 2 pounds less pressure than those in other portions of the body; consequently they expand. The first area to exhibit this congestion is the membrana flaccida and manubrium mallei. The same change can be seen in the ear of a crying baby or in the ear of one who is attempting to inflate his tympanum when there is obstruction in the eustachian tube. This is the condition classified as grade-1 ear.

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If at this time the pressure is reduced to atmospheric, the congestio disappears within a short time, usually in an hour but sometimes i a few minutes. Application of a vasoconstrictor to the ostium of th tube will greatly hasten the resolution of congestion and relieve th pain, even though the myringa still appears retracted, probably due t partial absorption of the air originally in the middle ear. Despit this apparent return to normal very few people can perform th Valsalva maneuver immediately after an experience of this sort, an require considerably more time for functional recovery.

If, however, the individual remains in the pressure chamber, an the pressure is increased another 2 or 3 pounds, expansion of the bloo vessels continues, affecting the entire tube, tympanum, and myring which now appears fiery red. This condition constitutes grade-2 ea At this time application of a vasoconstrictor to the tubal ostium wi not reduce the congestion of the drum, nor will it influence the pai Apparently, then, the vessels have become expanded beyond the limi of nervous control and are temporarily paralyzed. Only time wi bring about a return of function, which usually occurs in 8 to 72 hour depending on the degree of vascular paresis.

Congestion of the tube increases the difficulty of spontaneous infla tion, and the individual should be removed from the pressure cham ber; otherwise the grade of damage increases with the length of tim he remains inside the chamber. Congestion may occur at any tim if equalization of air pressure fails. Individuals are frequently see who easily equalize up to 20 or 30 pounds and then for some unknow reason stop. Then congestion quickly occurs with further increas in pressure, and the individual finds himself unable to equalize at al

Pain in this type of otitis has usually been ascribed to externa pressure on the myringa, but my observations lead to the conclusio that this is not entirely true. The myringa is well supplied with sen sory corpuscles, but these are not responsive to all types of stimuli For example, one can produce considerable pressure on the ear drum in the performance of the Gellé test without causing pain. Also, I have seen several patients with perforation of the myringa due t pressure, who stated that they had felt no pain and were unaware o the rupture. On the other hand the eustachian tube in most grade-3 ears can be easily catheterized, yet this inflation has no influence o either the congestion or the pain.

Hence it must be inferred that both pain and congestion are on th basis of vascular expansion and paresis. An analogy may be found i a toy rubber balloon which offers considerable resistance to inflatio up to a certain point and then begins to expand very easily. Bloo vessels likewise apparently have a critical point and when it is exceeded they temporarily lose their ability to contract.

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If the individual remains in the pressure chamber after this point is reached and the pressure is still further increased, the relative negative pressure in the tubotympanum likewise increases. In addition, some of the original air is absorbed, thus adding to the vacuum. As a result, a transudation of serum takes place, which may be noted as a fluid level, or as small droplets of fluid mixed with air. This is the condition classified as grade 3. Such an ear condition may require from 2 to 8 days for recovery, and myringotomy may be necessary. Inflation may be helpful after 1 or 2 days.

With further increase in air pressure, blood vessels of the tube or tympanum may rupture, induced occasionally by straining on the part of the individual. The entire tympanum may become filled with blood, in which case the ear drum appears solidly black, or there may be only scattered hemorrhages in various parts of the tympanum. Dissecting hemorrhages may occur in the myringa, or in the external canal, as already noted. Nasopharyngoscopy may reveal blood emerging from the ostium of one or both eustachian tubes. This condition is termed grade 4; it may require from 2 to 8 weeks for recovery.

Perforation of the myringa is also classed as grade 4, although admittedly in some instances it occurs very early owing to a previous weakening of the myringa. I have seen it occur before the drum has become congested. However it is usually a late manifestation occurring in either the flaccid or tense portion of the myringa. This latter represented the majority of perforations seen in this series. Many openings were rounded while a few were vertical slits. None received treatment of any kind and none became infected. The greater number healed quickly but a few remained patent after the lapse of several months.

If the perforation occurs early, the pain stops immediately, but if it occurs after vascular paresis has appeared, the pain may continue for several hours.

It would seem that although the term aero-otitis media expresses the etiology of this condition, the term salpingotympanitis would refer more specifically to the anatomic-pathologic changes in this condition, or if one wishes to include the etiologic factor in the nomenclature, one might use the term aero-salpingotympanitis.

Suppurative otitis and mastoiditis as complications of aero-otitis media were noted by Shilling and Everley. In this series, however, no such complication was seen. In 10 months at the submarine base, during which time more than 6,000 men were given the tests, no case of otorrhea was seen which was considered to have resulted from pressure damage to the ear.

Many textbooks mention auto-inflation as a cause of purulent otitis. Only 1 such instance was seen in this series. The man went through

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the tests without difficulty, and routine otoscopy yielded normal findings. Two hours later, however, he complained of pain in the left ear, which at this time was faintly pink but not retracted. He could still perform the Valsalva maneuver. Nose and throat findings were negative. The eustachian tube was treated with a vasoconstrictor and the patient dismissed. He returned 2 hours later complaining of severe pain. The ear drum was light red, bulging, and when it was incised a copious amount of seropurulent fluid was released. During the next 2 weeks, he had a very acute otomastoiditis, with high fever, but made a complete recovery. The acuity of the inflammatory process resembled frontal sinusitis after swimming. In both instances, soilage occurs on a clean, unprotected mucosa. This case indicates that the Valsalva maneuver may originate a suppurative otitis, but the occurrence of only 1 case in more than 6,000 men minimizes it as an etiologic factor.

TABLE 2.—*Analysis of data*

Total number of men in group	708	
Number classified as failures	47	(6.6%)
Number passed	661	
Number passed showing otopathologic changes	197	(30%)

As shown in table 2, 30 percent of the men who passed the tests had evidence of salpingotympanitis, although only 6.6 percent of the entire group had complained of pain and been classed as failures. In other words, nearly five times as many men had ear damage as complained of it. Questioning elicited a history of pain in all.

The percentage of failures in this group (6.6 percent) coincides with that of the cold weather period in group 1. (These observations were made in November and December.) All the failures occurred in the dry pressure tank. Forty-nine percent came out at pressures below 5 pounds; 25 percent came out at pressures of 6 to 12 pounds. This leaves only 26 percent who came out at pressures above 12 pounds, indicating that in the majority of cases, the eustachian tubes were obstructed before the tank was entered, and equalization never occurred.

Whether a man complained of pain at 1 or 2 pounds pressure or at 12 pounds, depended apparently on individual reactions. It was noted, however, that the longer a man stayed under pressure after pain began, the higher was the grade of his ear damage. Those who were able to equalize up to 12 or more pounds and then developed pain, in general were found to have stopped equalizing, and then after noting pain were no longer able to equalize. After instruction, the majority of these passed easily on a subsequent test. An analysis of the various grades of ear damage in this group is given in table 3.

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TABLE 3.—*Comparison of ear damage*

Grade of ear damage	0	1	2	3	4	Total
Passed	464	98	69	22	8	661
Failures	5	14	25	2	1	47
Total	469	112	94	24	9	708

With reference to the failures it should be noted first that 5 (11 percent) had normal hearing and normal appearing ears on emerging from the tank. Obviously, some other factor, as fear, general discomfort, tension and the like rather than actual otopathologic changes had induced them to complain of otalgia. Second, it should be noted that 39 (83 percent) had grades 1 and 2 ears, while only 3 (6 percent) had the more serious grades 3 and 4. On the other hand, of the 197 men who passed yet exhibited ear damage, 30 (15 percent) had grades 3 and 4 ears.

In other words, the men who complained of pain had less than half the percentage of grades 3 and 4 ears that were suffered by those who endured the pain and said nothing. From a statistical point of view, pain bears a reliable relationship to ear damage, but from a practical point of view, failure to admit pain makes it a very inadequate criterion of failure. Only routine otoscopy can determine the condition.

EVALUATION OF ETIOLOGIC FACTORS

To evaluate, if possible, the various factors which have in the past been held responsible for tubal obstruction, 858 men were examined before they started the pressure tests. Evidence of acute and chronic infections of the upper respiratory tract were noted, as well as the condition of tonsils and adenoids, clinical allergy, and obstructions of the nose due to septal deviations and spurs, hypertrophic turbinates and the like. Routine otoscopy was carried out on each man as soon as the pressure tests were completed.

Upper respiratory infections were graded as follows: No evidence of infection (0); slightly acute (s.a.); moderately acute (m.a.); slightly chronic (s.c.); and moderately chronic (m.c.). Men with severe infections were excused.

Tonsils were graded 1 to 4 on the basis of size and septic appearance. Adenoids were graded 0 if no adenoid tissue was observable; 1 if only a small midline mass was present; 2, lobes were well marked and touching the tubal labium; 3, larger mass encroaching upon the tubal ostium; and grade 4, a large, vegetative mass.

Septal obstructions were considered functional if they interfered with either sinal drainage, nasal breathing, or both. Obstructions below the middle meatus were generally considered nonfunctional.

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TABLE 4.—*Analysis of data*

Total number of men examined	858	
Number classed as failures	96	(11.2%)
Number passed	762	
Number passed with normal ears	553	(72.5%)
Number passed with evidence of otopathologic changes	209	(27.5%)

The 11.2 percent of the whole group classed as failures offers a contrast to the 6.6 percent of failures in group 2. The reason for this increase probably lies in the fact that more stress was laid on the need of indicating the presence of earache as a sign of trouble. In spite of this, however, practically the same percentage (27.5 percent) of the passed group showed signs of salpingotympanitis (aero-otitis media) as in group 2 (30 percent), again proving the inadequacy of pain as a criterion of ear damage. Table 5 gives a comparative analysis of the ear condition in the men of this group:

TABLE 5.—*Comparison of ear damage*

Grade of ear damage	0	1	2	3	4	Total
Passed	553	152	44	9	4	762
Failures	4	52	38	2	0	96
Total	557	204	82	11	4	858

It will be noted here, as in the second group studied, that 4 percent of the failures had normal ears and only 2 percent grades 3 and 4 ears. In the passed group with damaged ears, however, 13 (6 percent) had grades 3 and 4 ears. Thus the percentage of grades 3 and 4 ears among the failures was only one-third of that in the passed group.

Table 6 gives a brief analysis of the 96 failures in this third group studied, including findings on tonsils, adenoids and upper respiratory infection. Since the group is small, all grades of ear damage are considered together.

TABLE 6.—*Concurrent conditions*

Tonsils		Adenoids		Upper respiratory infection	
Grade	Cases	Grade	Cases	Grade	Cases
0	54	0	25	0	8
1	1	1	38	Slightly acute	62
2	28	2	31	Moderately acute	18
3	10	3	2	Slightly chronic	4
4	3	4	0	Moderately chronic	4
Total	96		96		96

Since according to this table, 54 of the failures had no enlarged tonsils and 25 no observable adenoids, it would appear that hyper-

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trophied tonsils and adenoids are not essential to the development of eustachian tube obstruction. It will be noted in addition that 29 men had grades 1 and 2 tonsils, and 69 had relatively small, grades 1 and 2 adenoids. When examined with the nasopharyngoscope however, practically all were seen to have adenoidal tissue in the eustachian tube, the fossa of Rosenmueller, or both.

The fact that only 6 percent were free from infection would indicate that infection is one of the factors operative in producing tubal obstruction; 80 patients had slight or moderately acute infections.

Tables 7, 8, and 9 correlate the findings in the third group studied and enable comparison between the groups with negative and positive otoscopic findings. Table 7 compares the grade of tonsils with the grade of ear damage:

TABLE 7.—*Comparison of tonsil grades with ear damage*

	Grades of tonsils					Total
	0	1	2	3	4	
Ear damage; grade:						
0	256	23	133	122	19	553
1	81	5	42	15	9	152
2	18	0	15	8	3	44
3	3	0	5	1	0	9
4	3	0	1	0	0	4
Total	361	28	196	146	31	762

Of this group, 361 did not exhibit enlarged tonsils and 224 showed grades 1 and 2 tonsils. Moreover the group with grade 4 tonsils had no ear involvement in 19 instances, grades 1 and 2 ears in 12 instances, and no grades 3 or 4 ears. In each tonsil grade there were far more negative than positive otic findings and the greatest number of damaged ears (105) was in the group with grade 0 tonsils. The conclusion that enlarged tonsils are not essential to the development of eustachian tube obstruction is thus confirmed.

Table 8 correlates grade of adenoid with grade of ear damage:

TABLE 8.—*Comparison of adenoid grades with ear damage*

	Grade of adenoid					Total
	0	1	2	3	4	
Ear damage, grade:						
0	184	184	171	14	0	553
1	48	56	46	2	0	152
2	17	12	12	3	0	44
3	3	4	2	0	0	9
4	2	1	1	0	0	4
Total	254	257	232	19	0	762

Table 8 indicates that 254 of a total of 762 men had no adenoidal involvement, and 489 had grades 1 and 2 adenoids. In the grade 3

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adenoid group, there were 14 men with negative ear findings, and only 5 with ear involvement. As with tonsils, there were far more negative than positive ear findings in each adenoid grade. In the grade 0 adenoid group, there were 70 men with ear involvement as contrasted with 73 in the grade 1 adenoid group. It may thus be concluded that enlarged adenoids are not the essential cause of eustachian tube obstruction. A large number of men with ear involvements did however on nasopharyngoscopic examination show evidence of growth of adenoidal tissue in the eustachian tubes.

Table 9 compares the grade of ear damage with upper respiratory infections:

TABLE 9.—*Comparison of upper respiratory infections with ear damage*

	Grade of upper respiratory infection					Total
	0	Slightly acute	Moderately acute	Slightly chronic	Moderately chronic	
Ear damage, grade:						
0	111	282	61	88	11	553
1	26	86	14	21	5	152
2	5	28	6	5	0	44
3	0	5	2	1	1	9
4	1	2	0	0	1	4
Total	143	403	83	115	18	762

From table 9 it is seen that while 442 of the group with normal ears had upper respiratory infections of some grade, 177 of the group with damaged ears also showed infection of some grade. This distribution would indicate that upper respiratory infection must play some part in the production of eustachian tube obstruction, although it is not the only factor.

Of 209 instances of ear damage (table 9), 143 were acute infections which usually were of relatively short duration. In most of these acute cases routine treatment restored the patency of the tube within a few days. Our treatment results however did not agree with those of Thorne (*4*) who noted immediate results in 21 percent of cases of "ear block." Thorne did not grade his cases, nor did he mention doing routine otoscopy on the men after they had taken pressure tests, consequently it is difficult to appraise his results. As he apparently relied on pain as a criterion of ear block, it is probable, from our experience, that he picked up only about one-fifth of the total number of cases.

EUSTACHIAN TUBE OBSTRUCTION

In many instances of upper respiratory infection the eustachian tubes were not patent even after the infection had entirely cleared. This finding, together with the fact that obstruction of the tubes

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occasionally occurred in the absence of any infection, pointed to a basic cause of such obstruction within the eustachian tube, and that while it could be influenced by infection, it still could operate independently. The number of men falling into this category constituted almost 3 percent of the total.

Farrior (*5*) has recently presented histologic evidence that acute and chronic infections in the eustachian tube may be responsible for tubal obstruction, as is also trauma from careless catheterization or massage. He has pointed out, as have others, that while lymphoid tissue is not normally present in the eustachian tube, it may develop there as a result of infection, spreading as far as the middle ear. In some instances gross nodules of lymphoid tissue can be seen in the labia of the tube and in Rosenmueller's fossa. In other instances there are no nodules and the presence of lymphoid tissue deeper in the tube can only be inferred. Since as Crowe (*6*) (*7*) (*8*) (*9*) (*10*) (*11*) and his associates have pointed out, this heterotopic lymphoid tissue may also be a cause of deafness, the deafness of which some of the patients in this study complained might well have been due to this cause rather than to pressure trauma.

ROLE OF NASAL OBSTRUCTION

Sixteen instances of deviated septum with obstruction were observed in group 3 in spite of selection methods. Of these men 3 failed, while 13 passed with negative ear findings. No instance of complete nasal obstruction due to hypertrophic turbinates or polyps was noted. It may therefore be concluded that nasal obstruction is not an important or frequent cause of obstruction of the eustachian tubes. The posterior end of the septum is on a frontal plane slightly anterior to the tubal ostium, so that it would be impossible for even an extensive septal deviation to involve the tubes, although bilateral nasal obstruction might so involve them. I believe that selective methods should lay more stress on patency of the eustachian tubes and less on septal deviations.

ROLE OF ALLERGY

It is to be regretted that the conditions under which this study was made did not permit much investigation of the important problem of allergy. Many of the patients were noted to have an allergic appearance in the nose, but since complete studies are lacking no statistics will be presented. Three men had nasal polyps although in each case there was clinical and roentgenologic evidence of sinus disease.

ROLE OF OTHER CONDITIONS

Nasopharyngeal tumors could easily obstruct the eustachian tube, but in this series no true tumors were recognized. Two cases of

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Thornwaldt cyst were seen, but in neither was the eustachian tube actually compressed.

Paralysis of the soft palate as well as scar tissue about the ostium of the tube have been mentioned as factors in producing tubal obstruction, but neither of these conditions was seen in this series. A number of cases were seen in which a previous otitis had produced scarring in the tympanum, and presumably in the tube, since some were unable to inflate the ear spontaneously.

Willhelmy (*12*) believed that overclosure of the mandible might affect the proper functioning of the tube. In this series, no such instance was recognized. With the nasopharyngoscope, I have in the past examined many people with overbite, and have not been convinced that the internal pterygoid muscle impinges on the eustachian tube to any greater extent than in the normal. I doubt very much if this condition should be classed among the causes of eustachian tube obstruction.

PREVENTION

A large percentage of damaged ears among submarine personnel could be avoided by a routine check of the ability of each candidate to autoinflate his ears. This is done by having him perform the Valsalva maneuver while the examiner observes the ear drum. If air enters the ear, a slight bulging will be seen in the upper portion of the pars tensa just posterior to the short process. If the tube is blocked, the upper portion of the drum will redden while the candidate is straining, but no bulging will appear.

In my experience, in any group of 30 men 7 to 9 would be unable to inflate the ears. If examination of the nose and throat disclosed infection, the infection would be treated. In a week or 10 days the group would be tested again, and if then able to inflate the ears, would be allowed to take the tests. If not, more time would be given for recovery. Probably all but 1 or 2 would eventually pass, the small remainder requiring further treatment.

It is therefore not necessary to test the man under pressure to find out whether or not he can inflate his ears and equalize air pressure. It is my contention that if this program were carried out, the number of cases with otopathologic changes would be 2 percent or 3 percent rather than the present 25 percent or 30 percent.

THERAPY

Various types of treatment of the damaged ears have been carried out. Formerly a group of 30 men had been subjected to submucous resection, but only in a few instances was any improvement noted. Tonsillectomy and adenoidectomy were done in about 100 cases, also with very disappointing results. It was therefore concluded that if

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either of these operations was indicated on its own merits it should be done, but relief from obstruction of the eustachian tube should not be expected. As noted previously, acute infections were treated conservatively, using the various vasoconstricting drugs. Some chronic infections were found to be unresponsive to conservative measures, and various surgical procedures were done.

Spontaneous recovery of damaged ears is the rule. Grade 3 ears that are not clear within a week may need myringotomy, while tympanal hemorrhages should be left strictly alone. For relief of pain, I prefer rest and sedatives to the use of phenol-glycerin or other drops in the ear. If a perforation is present, absolutely nothing should be placed in the ear. Inflation by catheter is of no value; it occasionally increases the pain and may traumatize the tube and delay healing. Time will usually heal the deafness, but in some cases there is permanent loss of hearing.

As noted some 3 percent of the cases failed to respond to therapy, and in these instances it is felt that irradiation of the eustachian tube by either radium or x-ray should give relief. Crowe and his coworkers have shown that such therapy restores normal patency and hearing in many cases, and it is logical that it would be of value here. Radon was used by Crowe and his associates and by Jones (*13*) while Farrior and Richardson (*14*), Fowler (*15*), Emerson, Dowdy and Heatly (*16*), and Fisher (*17*) used radium. In both instances, the radiation was applied in a capsule through the nose. X-ray has been used successfully by many.

Radium and x-ray of sufficient penetration for treatment are lacking at this station, but a small group of men was treated for us by another Naval hospital. While the results to the present are very promising, the series is too small to warrant a statistical report.

CONCLUSION

Evidence has been presented to show that of the commonly stated causes of eustachian tube obstruction, only upper respiratory infection and possibly allergy are at all important. The heterotopic growth of adenoidal tissue in the tube appears to be a definite factor, although this may be influenced by other factors. Theoretically irradiation by radium or x-ray, as demonstrated by Crowe and associates, should be the proper therapy in such cases, and a limited clinical experience appears to support this hypothesis. It is hoped that further investigation on this point will be carried out by others.

Grateful acknowledgment is made of the cooperation of Captain C. W. Shilling (MC) U. S. N., and Commander T. L. Willmon (MC) U. S. N., without whose valuable assistance and advice this study could not have been made, and to Ens. N. R. Bartlett, H–V(S), U. S. N. R., who reviewed the statistical portions of the study and whose criticism and suggestions proved to be of great value.

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ABSORPTION AND EXCRETION OF METHYLSALICYLATE

Methylsalicylate upon cutaneous application exerts not only its long-established counterirritant influence (vasodilatation, decongestion, induction of active hyperemia), but also a systemic action which perforce must be analgesic, antipyretic, and antirheumatic, since these properties are common to the salicylates upon absorption.—Beutner, R.; Calesnick, B.; Powell, E.; and Bortin, L.: On the absorption and excretion of methylsalicylate administered by inunction. J. Lab. & Clin. Med. 28: 1655–1663, November 1943.

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EVALUATION OF SYSTOLIC MURMURS

ARTHUR M. MASTER
Commander (MC) U. S. N. R.

Apical systolic murmurs are common and often it is difficult to determine whether a murmur is significant or not. In recent years (*1*) the tendency has been to discount the importance of a systolic murmur unless other evidence of organic heart disease was present, such as cardiac enlargement, heart failure, or abnormal electrocardiogram. This has been applied even to harsh or prolonged murmurs. However insurance company statistics have shown that systolic murmurs in the mitral area are associated with an increased mortality rate, particularly under the age of 40 years (*2*) (*3*) (*4*) (*5*) (*6*). Levine (*7*) believes that murmurs of definite roughness or loudness are significant of heart disease even in the absence of other signs.

In civilian practice it is usually possible to distinguish between functional and organic murmurs by performing a thorough examination including if necessary fluoroscopy, x-ray, electrocardiogram, phonocardiogram, and various functional tests. Also the patient can be re-examined periodically. Even if a definite diagnosis cannot be made, it does not matter very much when the cardiac function is good. Such a patient is able to lead a normally active life and should be encouraged to do so. In the military services, however, things are quite different. It is of the utmost importance, before accepting a recruit, to exclude men with organic murmurs, since experience with this war has shown that latent chronic valvular disease becomes manifest under the terrific stress of modern warfare.

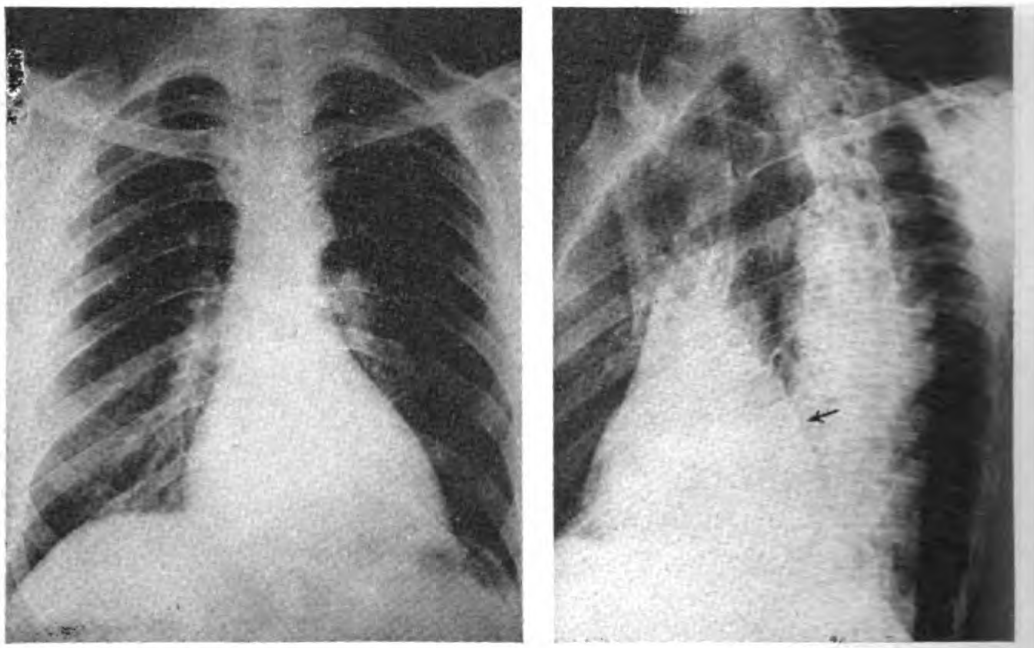
A review of war casualties at the United States Naval hospitals in Oakland, Treasure Island, Mare Island, and San Diego in December 1942, showed many patients returned from combat areas suffering from definite mitral valve disease. When these men had originally been examined by the recruiting officer, the lesion had apparently been occult. Only a systolic murmur was heard and this was considered functional. In view of the findings at the time of my examination, which also elicited the history of rheumatic fever in childhood in the majority, the men undoubtedly had had latent organic heart disease before entering the Navy. In ordinary civilian life this type of heart disease is compatible with full cardiac compensation and complete activity, but not in wartime. I shall cite two cases illustrating this group of patients.

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CASE REPORTS

Case 1.—An apprentice seaman, 21 years old, enlisted 19 December 1941. While serving aboard the U. S. S. —— he reported to the sickbay 16 March 1942 after standing prolonged lookout duty. He complained of pain under the sternum and was completely fatigued. After being transferred to the hospital, definite presystolic and systolic murmurs were heard at the mitral region. An x-ray showed a "typical mitral configuration." On close questioning, a history of rheumatic fever at the age of 14 years was disclosed.

Case 2.—A 39-year-old chief pharmacist's mate became short of breath after very strenuous physical exertion on a destroyer. When seen at the hospital a loud systolic murmur was heard at the mitral area. Electrocardiogram revealed abnormal P-waves, and the left auricle was enlarged in the x-ray film. This patient had had rheumatic fever when 15 years of age. The abnormal P-waves in the electrocardiogram and the large left auricle attested to the presence of rheumatic mitral valve disease (*8*).



1. (Case 3.) Teleroentgenogram in postero-anterior view reveals a wide waist. There is fullness in the region of the left auricular appendage and pulmonary artery. The left oblique position discloses left auricular enlargement.

The conclusions to be drawn from these cases are obvious. The physical strain of modern warfare is apt to precipitate heart failure in those with organic valvular disease. In examinations of recruits or candidates great care must be taken to elicit any history of rheumatic fever in childhood. If this background is present, or if any systolic murmur is heard, a thorough investigation should be made for mitral valve disease. If necessary, the examination should include teleroentgenogram, fluoroscopy, and electrocardiogram. In the physical examination, auscultation should be carried out in all positions,

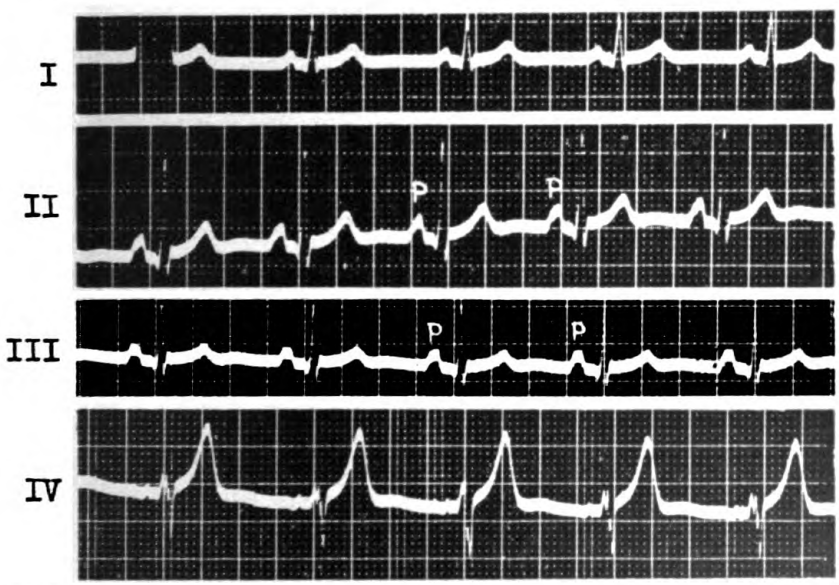
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including the left lateral, the sitting, and the recumbent, as well as after exercise, since a loud prolonged murmur may appear under such circumstances. It may be necessary to examine the patient on several occasions before excluding organic valvular disease.

The following cases seen at the National Naval Medical Center, Bethesda, Md., illustrate the need of employing all these examinations in order to make a correct diagnosis.

Case 3.—An officer candidate, 40 years of age, had been called up from the Naval Reserves for active duty. A systolic murmur present over the apex had been interpreted as functional by the man's civilian physician and a cardiologist. However, teleroentgenogram in the postero-anterior view showed a "wide waist" produced by prominence of the pulmonary artery and left auricular appendage (fig. 1). The left oblique view also disclosed left auricular enlargement with some increase in size of the left ventricle. These findings proved that the systolic murmur was produced by organic mitral valve involvement.

The value of observing the left auricle in the left oblique position has not been sufficiently appreciated. Early enlargement of this chamber often can be observed in this position before it has advanced enough to elevate the left main bronchus or indent the esophagus containing barium. In the left oblique position the left auricle is seen on the upper border of the left ventricle which is near the vertebral column.



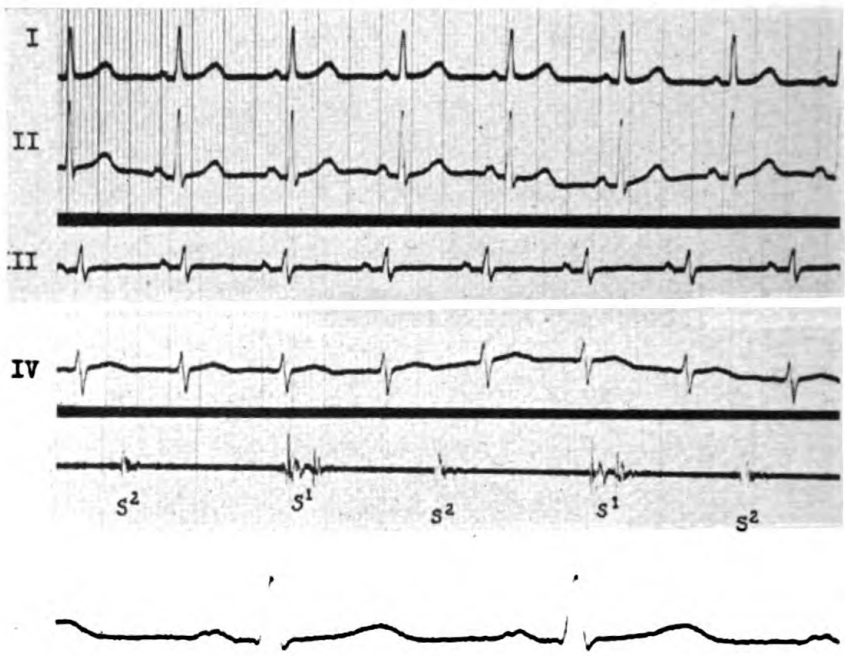
2. (Case 4.) Systolic murmur over mitral region. Large P-waves, associated with auricular enlargement.

Case 4.—A 20-year-old storekeeper, third class, was up for promotion and was examined because of a systolic murmur. A history of muscle pains at the age of 9 years for 2 months was obtained. A rough systolic murmur was heard over the apex with a "sea gull" overtone. Because of the presence of the latter, the

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diagnosis of organic mitral valve disease was made and this was confirmed by the electrocardiogram (fig. 2) which showed large P-waves. P-waves more than 2.5 mm. in amplitude or 0.10 second in duration, or markedly notched, usually indicate auricular enlargement (*9*) (*10*) and in the presence of a systolic murmur speak for the diagnosis of a mitral valve lesion.

Case 5.—A nurse, returned from Corregidor, raised the question whether a systolic murmur, a presystolic murmur, or a split first sound was present over the mitral area. The x-ray film and electrocardiogram were negative. A phonocardiogram showed splitting of the first sound and no murmur (fig. 3). The splitting was a functional sound. A split first sound appears at the beginning of systole only, i. e., directly after the R-wave in the electrocardiogram, and the amplitude of each of the split portions of the sound is the same and is larger than is ordinarily observed in murmurs.



3. (Case 5.) Split first sound with no evidence of systolic or diastolic murmur.

A presystolic murmur is often associated with a systolic one. In fact, the establishment of any diastolic murmur is proof in itself of an organic lesion and thus enhances the importance of the systolic murmur, no matter if the latter be faint or of short duration.

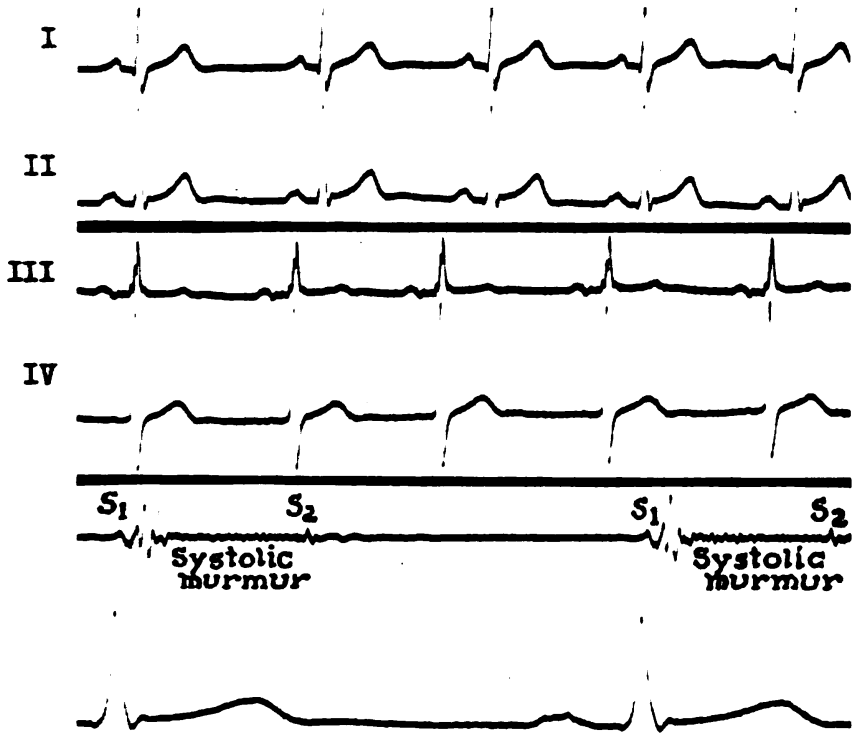
It has been my experience that not only a loud systolic murmur but a prolonged one is good evidence of organic mitral valve disease. A phonocardiogram may be necessary when there is a question as to the length of the murmur.

Case 6.—A 17-year-old lad, a candidate for the Marine Corps, presented a murmur which the recruiting medical officer considered to be of the nature of an organic mitral valve defect, but this interpretation had been doubted by other physicians who heard only a short murmur. Otherwise the past history,

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physical examination, fluoroscopic and electrocardiographic examinations were negative. The heart sound tracing (fig. 4) revealed a prolonged systolic murmur throughout entire systole, i. e., from first heart sound to second, thus proving the presence of a systolic murmur and confirming by its long duration its organic character.

There are two common conditions which may produce a systolic murmur or changes in the teleroentgenogram and electrocardiogram similar to those seen in rheumatic heart disease and which must be differentiated from that condition. They are the "small heart" of effort syndrome (neurocirculatory asthenia) and funnel-shaped chest.

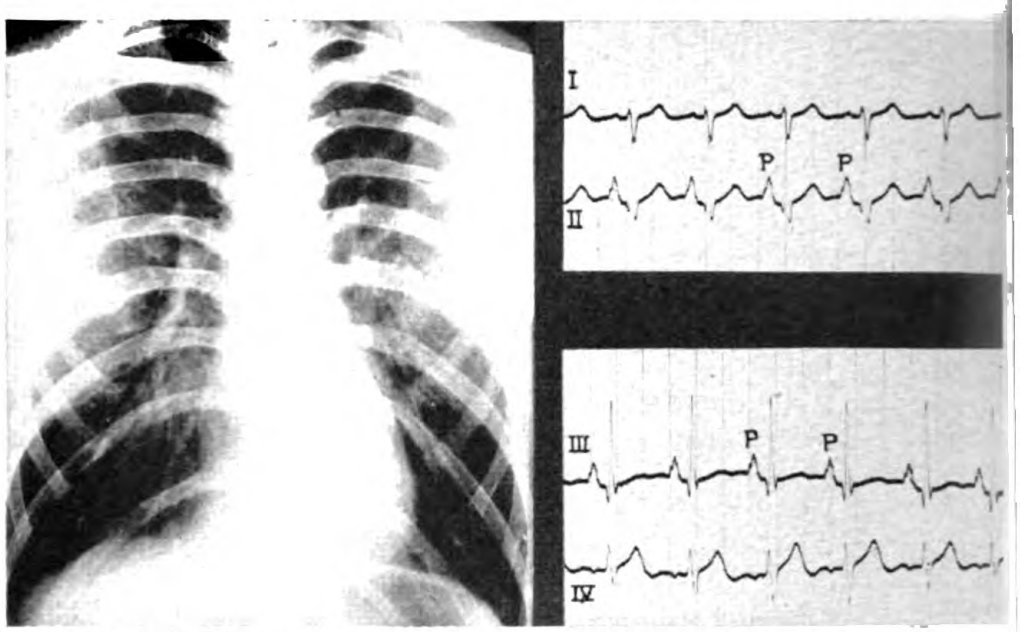


4. (Case 6.) Chronic rheumatic cardiac valvular disease. Electrocardiogram normal. Murmur throughout systole.

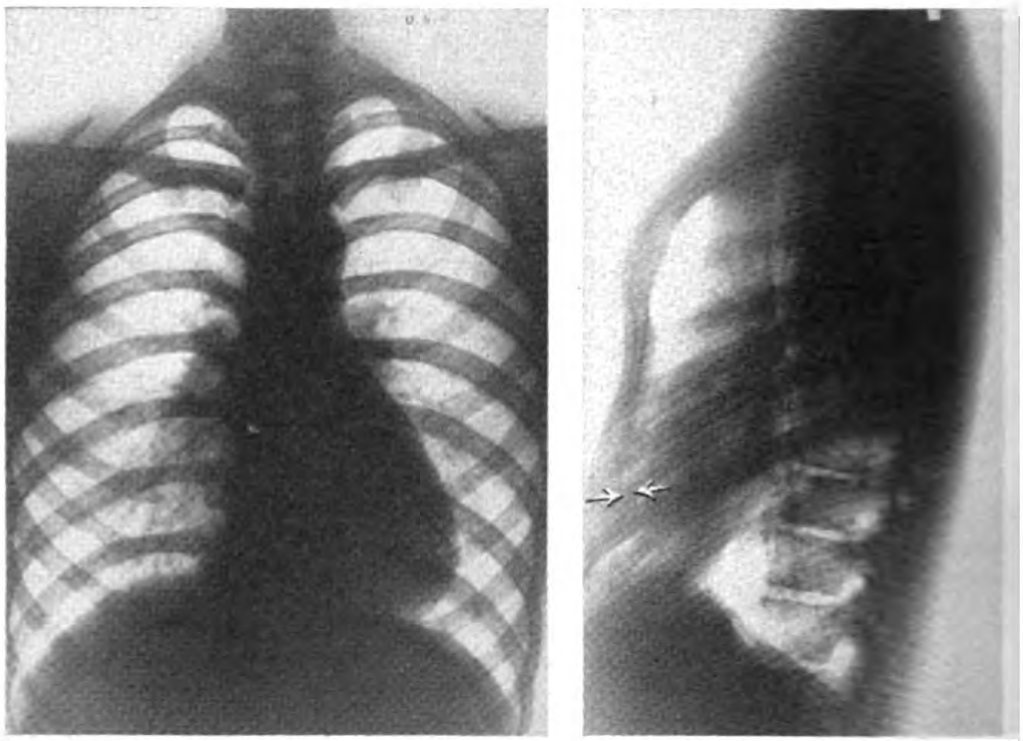
In the "small heart" of effort syndrome there may be a systolic thrill and murmur at the mitral area, a snappy first sound, an accentuated second pulmonic sound, prominence of the pulmonary artery, large P-waves, and other changes in the electrocardiogram.

Case 7.—A 31-year-old candidate for the Navy was very slender and flat chested. He was 5 feet 10 inches tall and weighed only 120 pounds. The heart rate was 105 per minute. The teleroentgenogram (fig. 5) showed straightening of the upper left cardiac border as seen in mitral valve disease. The electrocardiogram disclosed right axis deviation and large P-waves, findings usually associated with auricular and right ventricular enlargement as seen in mitral disease. However, they are also found in the effort syndrome with a "small heart" (8). This diagnosis was made in this case because of the absence of left auricular enlargement determined fluoroscopically and the presence of a small narrow heart.

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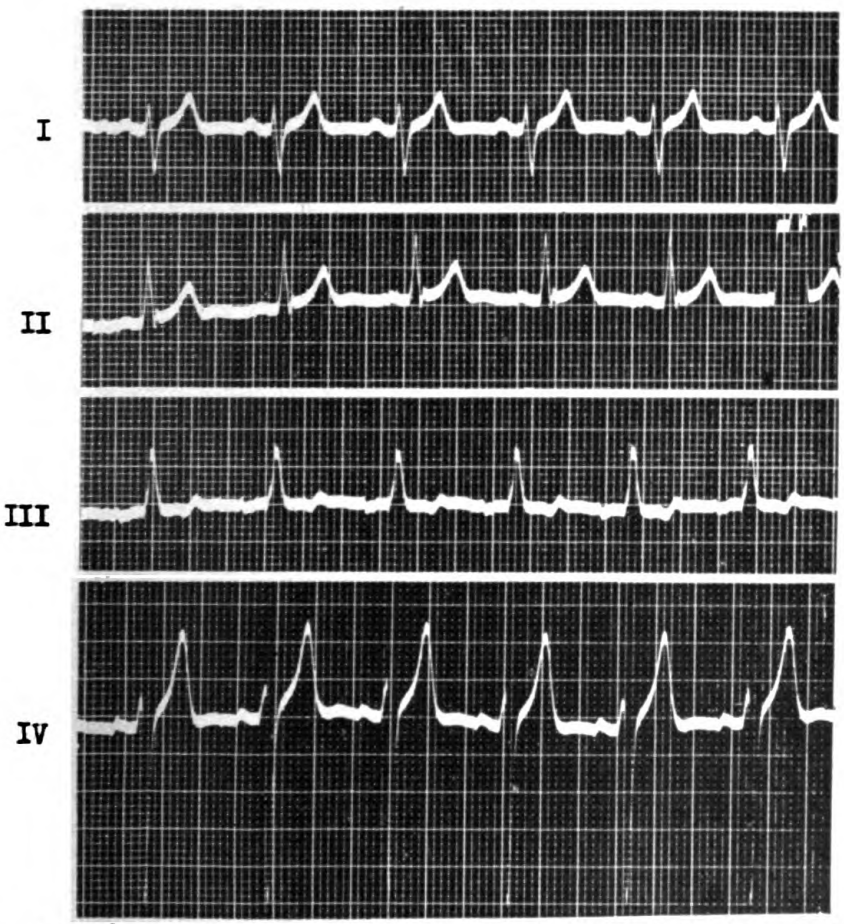
5. (Case 7.) Teleroentgenogram shows low diaphragm with narrow, pendulous heart and straightened left border. Electrocardiograms show a right-axis deviation of the QRS group, low amplitude in lead I with relatively large amplitude in leads II and III, and finally large P-waves in these two leads. The heart rate was about 105 per minute.



6. (Case 7.) Thrill at apex and loud systolic murmur over pulmonic, mitral and apical areas. Teleroentgenogram: Heart displaced to left, and lateral view reveals funnel-shaped depression (arrow).

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The funnel-shaped chest frequently produces a systolic murmur and even a thrill at the apex. The depression of the sternum may appear insignificant externally but teleroentgenogram, or preferably fluoroscopy, may show a genuine depression of the sternum (fig. 6) and the heart definitely displaced to the left. The electrocardiogram may reveal right axis deviation and abnormal P-waves, as seen in mitral valve disease (fig. 7). The heart was found completely dis-



7. (Case 7.) Electrocardiogram discloses right axis deviation and polyphasic or notched P-waves in leads II and III.

placed into the left chest in 18 of 20 men examined. In all of these there was no evidence of mitral valve disease, and the systolic murmur when present was therefore functional.

CONCLUSIONS

A systolic murmur at the mitral and apical areas may be important and should always be given serious consideration until definitely proved of functional origin.

Persons with a systolic murmur and a past history of rheumatic fever should be considered to have rheumatic mitral valve disease

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unless repeated examinations, including laboratory aids, prove the absence of organic disease.

A loud murmur or one prolonged throughout systole usually indicates organic heart disease. A heart sound tracing may reveal the prolonged nature of the murmur when auscultation does not.

Repeated physical examinations, examination after exercise and in different body positions are necessary when systolic murmurs are faint or short, i. e., of doubtful significance.

The presence of a diastolic murmur confirms the organic nature of the systolic murmur.

A "sea gull" murmur is usually evidence of an organic lesion.

The heart sound tracing will clear up doubt as to whether a systolic murmur or a split first sound is present.

An abnormal P (auricular) wave in the electrocardiogram may confirm the presence of an enlarged left auricle, and right axis deviation may indicate right ventricular enlargement.

Fluoroscopy and teleroentgenography are important adjuncts in the diagnosis of enlargement of the cardiac chambers, particularly the left auricle. The left oblique position may reveal early enlargement of the latter chamber before elevation of the left main bronchus occurs or before indentation of the esophagus appears when barium is ingested. Enlargement of the left auricle confirms the organic origin of a systolic murmur.

Latent and occult rheumatic mitral valve disease, masquerading as a functional systolic murmur, becomes apparent and disabling under the physical and mental stress of modern warfare; heart failure may appear. It is extremely important in the war emergency to evaluate systolic murmurs, no matter how short or faint, and no matter how good the cardiac function appears to be at the time of examination.

A systolic murmur is frequently heard in patients with the small heart of effort syndrome (neurocirculatory asthenia) or in persons with funnel-shaped depression of the sternum. These two conditions must therefore be kept in mind.

The conclusion for the Navy is that if a candidate with a doubtful systolic murmur cannot return for another examination and if it is impossible to determine immediately whether the systolic murmur is functional or organic, he should not be accepted in the Navy for general service. In wartime a systolic murmur should be taken to be serious unless proved of functional origin.

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COUGH SIGN IN ACUTE APPENDICITIS

In eliciting the sign the examiner places the tips of his fingers under the left costal margin in the region of the spleen. The patient is then asked to take a deep breath, exhale completely, and then cough. When positive, the patient will point to the area of the suspected appendix as the site of severe pain. This sign is rarely mentioned in text books on medicine, nor is it emphasized in the voluminous literature on this disease.

In a series of 400 cases admitted for acute abdominal diseases, the cough sign was found almost pathognomonic of acute appendicitis, occurring three times as often as in nonappendicial diseases.—Ben-Asher, S.: The value of the cough sign in acute appendicitis. Am. J. Digest. Dis. 10: 368–370, October 1943.

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FALSE POSITIVE SEROLOGY IN MALARIA

A diagnosis of syphilis is a serious matter, and its implications may be far reaching. Equally serious and sometimes disastrous is a diagnosis of syphilis in some one who does not have the disease.

From numerous studies it has been shown that yaws, leprosy, infectious mononucleosis and malaria are diseases in which positive serologic tests for syphilis can be frequently expected. In occasional instances other conditions, e. g., pneumonia, vaccinia, measles, and other acute febrile diseases may give rise to false positive tests.

Since yaws and leprosy are extremely infrequent diseases in the United States, it will be seen that infectious mononucleosis and malaria will be the chief causes of biologic false positive serologic reactions. Unfortunately both of these diseases are quite common and often are present in a subclinical state.—Dawber, T. R.: On the importance of malaria as a cause of false positive serologic reactions. Ann. Int. Med. 19: 651–655, October 1943.

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PAROXYSMAL CARDIAC PAIN

THE DIFFERENTIAL DIAGNOSIS AND TREATMENT OF "ANGINA PECTORIS"

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The nature of the multiple morbid processes associated with "angina pectoris" has not been appreciated by many observers, even though numerous clinical descriptions have been recorded. Many sound, able individuals have been erroneously frightened into semi-invalidism and made cardiac cripples by the casual application of this sinister term to their disturbance. Conversely, far too often a patient, after being reassured that his ailment is merely a "slight attack of angina," drops dead within a few hours, much to the astonishment of the disillusioned physician. The exceedingly variable clinical picture is further confused by the use of such terms as "pseudo angina," "true angina," and "malignant angina."

Angina pectoris has been variously described as a paroxysmal painful sensation over the precordium which tends to radiate, and is relieved by rest, nitrites, and narcotics. It has also been described as a transitory attack of precordial or substernal pain produced by effort or excitement. These are entirely clinical syndromes with no positive ascribed pathologic changes. The anginal syndrome is a physiologic diagnosis and is not synonymous with coronary artery disease, yet many persist in using the terms angina pectoris, coronary artery disease and coronary sclerosis interchangeably. Because to the laity angina pectoris presages an impending, terrifying death, and the indiscreet use of the term has worked untold hardships, it would seem reasonable to substitute the term paroxysmal cardiac pain. With this designation the etiology may be scientifically qualified.

The pain may arise in the cardiac region and be manifested as an extracardiac factor within the mediastinal tissues or the diaphragmatic portion of the fibrous precordium. Or it may be shown as an intracardiac factor. A painful sensation of cardiac origin is almost invariably due to myocardial ischemia or anoxemia from an inadequate blood supply. The disturbance may be either quantitative or qualitative. Any factor that increases the need of the heart muscles for blood or diminishes the coronary flow may produce pain. A normal blood supply may be inadequate under conditions of stress;

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a diminished blood supply may be inadequate under conditions of minor stress.

The following clinico-pathologic classification of morbid conditions giving rise to paroxysmal cardiac pain (*1*) is offered in the attempt to clarify the confusion resulting from protean employment of the term angina pectoris:

Paroxysmal pseudocardiac pain is paroxysmal pain about the precordium not of cardiac origin.

Paroxysmal benign cardiac pain is paroxysmal pain about the precordium in which the pain arises in the heart. It is the result of a qualitative or quantitative disturbance of the coronary circulation. Pathologically there is no significant evidence of coronary artery disease.

Paroxysmal malignant cardiac pain is paroxysmal pain arising about the precordium caused by disease of the coronary arteries which produces cardiac ischemia.

PAROXYSMAL PSEUDOCARDIAC PAIN.

Paroxysmal pseudocardiac pain is not associated with either a disturbance of the coronary circulation or actual coronary disease. The origin of the pain is entirely extracardiac. A common form is the pain arising from osteoarthritis of the cervical spine. Attention has been drawn frequently to the similarity between heart pain and the referred pain of root irritation in hypertrophic spondylitis. Some of the latter patients even experience relief from the use of nitrites. The arthritic pain may be referred over a large area of the chest and to the shoulder; it occurs in individuals past middle life and is associated with exercise of the upper extremities.

Mechanical irritation of the brachial plexus as it passes over the first rib between the scalene muscles activates the scalenus anticus syndrome which is often wrongly diagnosed as angina pectoris. Spontaneous mediastinal emphysema is usually secondary to a spontaneous left-sided pneumothorax. In this condition severe precordial pain is often present. Crackling sounds are heard on auscultation over the precordium similar to those produced by pinching an inflated balloon and allowing the fingers to slip over the surface—a sign that is considered pathognomonic by Hamman (*2*). Gas imprisoned in the splenic flexure will produce pain radiating upward over the precordium, and in addition will produce dyspnea, pallor, and rapid pulse.

Probably the most frequent cause of paroxysmal pseudocardiac pain, however, is the syndrome of neurocirculatory asthenia. The familiar symptoms are palpitation, nervousness, irritability, exhaustion, anorexia, giddiness, breathlessness, and sighing respirations. The pain is prevalent among women of labile nervous systems during the climac-

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teric. The pain may be either dull or lancinating in character; it is not retrosternal, oppressive, or vise-like and is not clearly related to exertion. It often appears in individuals who have been in intimate contact with patients suffering from pathologic cardiac pain.

A number of other causes of paroxysmal pseudocardiac pain could be mentioned, including diaphragmatic hernia, pneumothorax, pneumonia, gallbladder crises and duodenal ulcer.

PAROXYSMAL BENIGN CARDIAC PAIN.

1. Paroxysmal benign cardiac pain is associated with a disturbance of the coronary circulation without actual coronary artery disease. In the various anemias, including pernicious anemia, the myocardium is receiving an inadequate qualitative blood supply and precordial pain is often experienced.

Physiologists have pointed out that coronary circulation is largely dependent upon blood pressure, particularly the diastolic pressure. The coronary arteries fill during the diastole and early part of the ventricular systole. In individuals with hypotension the coronary flow is impaired and they may experience precordial pain. Dynamic studies have shown that the faster the heart beats, the more the systolic output or stroke volume is decreased. It follows that an attack of paroxysmal tachycardia can bring about a diminished coronary flow with resulting paroxysmal benign cardiac pain.

Although physiologists are at variance regarding the action of nicotine on the cardiovascular system, clinically at least the drug seems to produce a relative myocardial ischemia in susceptible individuals, either by vasoconstriction of the coronary arteries or by increasing the work of the heart. Upon smoking, T-wave inversions of previously normal electrocardiographic readings have been observed in a large group of subjects (*3*).

Decreased coronary flow has been disclosed with the administration of digitalis to experimental animals. This is assumed to be caused by a coronary constrictive action of digitalis, although some investigators believe it is due to the increased work of the heart. The indiscriminate use of this drug in patients with normal rhythm but accelerated rate may result in precordial pain.

In thyrotoxicosis, a diminished relative blood supply to the heart results from the tachycardia, the diminished stroke volume, and the increased metabolism.

2. The hyperventilation syndrome is closely allied to neurocirculatory asthenia, except that the precordial pain is more severe. Curiously enough the syndrome brings about marked electrocardiographic abnormalities, consisting of late T-wave inversions, or S–T depressions in apparently normal hearts (*4*). This phenomenon has been attributed to an alkalosis which produces coronary constriction (*5*).

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3. Hall (*6*) has called attention to the grave potentialities of marked autonomic nervous system imbalance with vagus overactivity. With repeated injections of the vagus substance in dogs, he was able to produce myocardial lesions closely simulating infarctions.

Of great importance is the ability of gastro-coronary reflexes to produce cardiac pain in the presence of otherwise "silent" coronary artery disease. Von Bergmann (*7*) observed that the inflation of a balloon in the stomach of the dog produced vasoconstriction of the coronary arteries. In man an episode of upper abdominal distress or indigestion may provoke reflex coronary artery constriction with precordial pain, but the myocardial ischemia is evanescent and myocardial changes reversible.

PAROXYSMAL MALIGNANT CARDIAC PAIN

Paroxysmal malignant cardiac pain implies pathologic changes in the coronary arteries, which impair the blood flow to the myocardium. Rheumatic involvement of the coronaries is rare but is seen occasionally. Syphilis, strange to relate, plays a minor role in the etiology of coronary artery disease. It affects the coronary orifices only by direct extension from the aorta. Polycythemia vera, through inspissation of blood, might favor coronary thrombosis. Periarteritis nodosa and thromboangiitis obliterans but occasionally involve the coronary arteries. Embolic phenomena in the coronary arteries are rare. They may be found occasionally in cases of acute and subacute bacterial endocarditis and rheumatic mitral heart disease.

The most common disorder of the coronary arteries is arteriosclerosis. Atherosclerotic changes are said to occur at birth and may gradually progress until death without impairing the circulation to the myocardium. On the other hand the process may become eccentric and definitely narrow the lumen, causing diminution of the blood flow. Under these conditions, any abrupt increase in the work of the heart, or any abrupt drop of blood pressure in the aorta, will cause an acute coronary insufficiency, giving a spasmodic character to the clinical picture.

The clinical manifestations of coronary artery sclerosis seem to follow four distinct patterns:

1. The typical pain group.
2. The gastro-intestinal group.
3. The respiratory group.
4. The atypical group.

The main characteristic of the pain associated with coronary artery sclerosis is its direct relationship to effort or emotional strain. The patient states very simply that walking or lifting or excitement produces a sensation in the chest, or at times in the arms, that compels an arrest of activity. After a few moments of rest, the distress is gone

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and the patient feels as well as ever. The pain is usually behind the middle or lower sternum. It may radiate down the left or right arm, both arms, into the back, or up into the jaws. It is usually described as a vise-like or oppressive sensation.

Very frequently also coronary artery sclerosis manifests itself by gastro-intestinal disturbances simulating, at times, gallbladder disease or duodenal ulcer. The patient complains perhaps of a vague, nauseating distress in the upper abdomen with a desire to belch. The picture may also resemble splenic infarct or renal colic.

The respiratory symptom complex of coronary sclerosis is quite familiar. The patient complains of dyspnea on exertion, with no pain or paroxysmal nocturnal dyspnea.

The atypical group, usually noted in older patients, may be characterized by fainting attacks with pallor, great restlessness with sweating, or congestive heart failure, but no pain.

In spite of careful investigation, about 20 percent of the patients with coronary artery sclerosis reveal no objective clinical abnormalities. All too frequently, however, the presence of a disease process of the coronary arteries is not suspected until an acute occlusion occurs. In acute myocardial infarctions the electrocardiogram is invaluable but even here normal electrocardiograms have been observed.

Master (*8*) and his associates firmly believe that the initiation and progression of coronary thrombosis to occlusion occurs irrespective of physical activity or lack of activity. Others (*9*) (*10*) are of the opinion that some cases of coronary occlusion result from severe exertion or unusual effort. In these latter there must be a sequence of events to come to such a conclusion. The time interval between the coronary artery thrombosis inception and complete occlusion of the vessel is important. Often between the primary capillary intramural hemorrhage and clinical picture of severe myocardial anoxemia with infarction, hours or even days may elapse.

The symptoms of acute sudden closure in the coronary artery are usually very dramatic and too familiar to recount here. However attention is directed to one important sign. The occurrence of a temporary hyperglycemia and glycosuria following a coronary thrombosis is a physiologic response of the body. A relatively high blood sugar is of definite advantage to the cardiac patient. To administer insulin in these cases is not only unnecessary, but may result in death.

THERAPY

The precise nature of the disturbance must be determined before treatment can be instituted. It is apparent that the heart may withstand repeated major insults to the coronary circulation without clinical and even pathologic manifestations. Coronary artery thrombosis with occlusion need not necessarily lead to myocardial infarction.

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Effective collateral circulation may develop in a relatively short time provided there is no excessive cardiac strain. Anticipatory complete bed rest will not forestall the threatened occlusion but may diminish the area or intensity of myocardial ischemia, so that even though classical pain is present, no other clinical or electrocardiographic signs of acute myocardial infarction are observed.

Of vital importance is the control of pain. Experimentally it has been demonstrated that the high mortality following acute coronary occlusion is the result of the development of a relatively large area of ischemia brought about by reflex spasm of collateral arterial branches (*11*). Abolishment of pain may prevent this reflex spasm of collateral coronary branches.

Papaverine hydrochloride is reputed to relieve smooth-muscle spasm and also has a sedative effect. As an analgesic it is less effective than morphine. Morphine, however, sometimes complicates the course of acute coronary occlusion by its vagotonic action. That is, it may promote constipation and distention, urinary retention, nausea and vomiting, and enhance the development of myomalacia by vasoconstricting action on the coronary arteries, thus rendering the heart more susceptible to ventricular ectopic rhythms. Spasmalgin, a combination of pantopon, papaverine, and a belladonna derivative, is free of these toxic morphine effects and has seemed to produce beneficial clinical results, as has the intravenous and oral administration of large doses of papaverine (*12*).

Oxygen in high concentrations should be administered immediately, even in the absence of respiratory embarrassment. Not only is the pain alleviated but beneficial cardiorespiratory function is maintained and the small collateral circulation thus fortified may reduce the size of the infarcted area. Collapse of the cardiovascular system in acute coronary occlusion is a form of peripheral circulatory failure. It is therefore well to administer caffeine sodium benzoate parenterally in addition to other measures. Use of digitalis is contraindicated.

The ectopic rhythms which occur following an acute myocardial infarction are usually transitory and benign. Ventricular tachycardia may be the exception, but Master (*13*) found that it occurred in acute coronary occlusion very infrequently except following the use of digitalis. Epinephrine, too, appears contraindicated, except perhaps as a heroic measure in complete A–V dissociation or cardiac standstill. It enhances the irritability of the ischemic area and may provoke a fatal idioventricular rhythm, as ventricular tachycardia or ventricular fibrillation.

It has been reported that ventricular tachycardia complicating acute coronary artery thrombosis can be abolished by the use of quinidine (*14*) (*15*), and now it is universally believed that the drug may control this purposeless, inefficient rhythm. However the drug by its toxic

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action may not only fail to slow the rate by restoring normal sinus rhythm, but on the contrary may bring about ventricular fibrillation (*16*). Only when the acute myocardial reaction has subsided are we justified in risking quinidine, for then there is not present the marked myocardial irritability of the acutely infarcted area and we can reasonably accept electrocardiographic evidence of absence of conduction defects as indicating a healthy conduction system.

One old therapeutic measure deserves honorable mention. Experimentally (*17*) it has been demonstrated that the administration of a mixture of theophylline ethylenediamine and atropine sulfate to conscious dogs 5 minutes after arterial occlusion greatly reduces the mortality. The intravenous administration of some xanthine preparation, preferably theophylline ethylenediamine, seems to increase coronary flow, but relatively large doses are necessary and the effect is of short duration (*18*).

To forestall the development of intravascular and mural thrombi the use of anticoagulants has been advised. Due to its cheapness, long action, and the fact that it is active on oral administration, dicoumarin possesses many advantages over heparin. However the long latent period before its effect is demonstrable, and the impossibility of terminating this effect quickly, may constitute disadvantages. Before clinical use of these preparations can be recommended, further investigation is indicated.

Diabetes mellitus complicates the heart picture. The diabetic heart stores glycogen better if the blood sugar is maintained well above normal levels. After long-standing diabetes the heart becomes accustomed to an elevated blood sugar. Sudden reactions in the blood sugar level brought about by reduction in diet or by insulin are not well borne; therefore it is better to resort to the cautious intravenous administration of supportive dextrose. Too critical control of the hyperglycemia may have catastrophic results.

Grollman (*19*) has shown that the cardiac output may increase by as much as 2 liters a minute after a heavy meal. The deleterious effects of this increased load on the heart already laboring under dire difficulties are obvious. The advantages of a low caloric diet in eliminating gastrocardiac reflexes and diminishing the work of the heart has been stressed by Master (*8*).

Subsequent to the completion of the healing process of an acute myocardial infarction and for coronary insufficiency in general, the following procedures may be of therapeutic value.

The patient's activities should be limited if possible, but not to the point of making him an invalid. He should be instructed to lead a calm, quiet, orderly existence, avoiding strain and excitement. He must be taught to acquire an air of philosophic calm. These tenets are of course academic as regards their application to active naval duty.

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He should avoid overeating and fast eating. Food should be preferably simple and easily digestible. If overweight, the patient should reduce. He should be told to rest in bed, with shoes, coat, vest, collar, and tie off, 1 hour after lunch daily. Tobacco in any form, and high altitudes should be avoided. Mild sedatives, as small doses of phenobarbital or bromides, are of advantage in maintaining mental calm. Theobromine and theophylline derivatives have been proved to increase the coronary flow.

In the light of present-day knowledge, surgical procedures may be resorted to in cases of intractable coronary insufficiency in the attempt either to diminish the myocardial demands or to increase the coronary blood flow. McEachern and his coworkers (*11*) have demonstrated that removal of the cardiosensory pathways eliminates the pain and reduces the mortality after sudden and permanent occlusion of a large branch of the coronary artery in dogs. Yet the studies of Yodice (*20*) seem to indicate that sympathectomy produces only a short and slight beneficial effect and cannot be considered an effective method of reducing mortality or size of infarcts resulting from acute coronary occlusion.

Total ablation of the thyroid attempts to diminish the myocardial demands but is not of sufficient merit to justify this grave surgical procedure.

The artificial production of a sterile adhesive pericarditis might be conducive to the development of a functioning collateral circulation to the heart. The production of a sterile inflammatory reaction between the epicardium and pericardium by the direct introduction of an irritant substance into the pericardial sac has been demonstrated by many investigators. Parietal grafts to the abraded myocardium with the production of an adhesive pericarditis have been employed for the same purpose. It must be remembered that these surgical procedures are delicate and tedious with considerable risk to a patient with an incompetent heart.

In conclusion, it is well to appreciate that the therapeutic measures at hand are often of no avail in abating a progressive degenerative vascular process. The prognosis of these cases is one of the great variables. The failure to recognize the influence of psychogenic disturbances upon the subjective symptoms will inevitably lead to therapeutic failure. The patient must be told how to avoid attacks if possible, and must be reassured. The importance of human relationships may be too lightly regarded. The organic disease cannot be cured, but the physician can mold the outlook and activity of the patient so that he attains some degree of adjustment and harmony during his remaining days. This humanistic attitude is not easy of achievement.

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THE CARRIER PROBLEM IN THE DISSEMINATION OF HEMOLYTIC STREPTOCOCCUS

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It is generally believed that the outbreak of a streptococcal epidemic is associated with the existence of a high carrier rate. This is frequently true. Under such conditions, however, it is extremely difficult to detect those individuals who spread contagion. Moreover, it is also true that the introduction of a single individual infected with hemolytic streptococcus may give rise to an outbreak of streptococcal infections in a colony when the carrier rate is minimal. This circumstance may occur when seasonal conditions are favorable to the host and unfavorable to the respiratory pathogen and when the infecting organism is new to the colony (*1*). Under these conditions, it is possible to recognize the host that is spreading contagion. Such a host is a *dangerous* carrier; he disseminates organisms that have a great capacity to multiply in the human nasopharynx. This is a highly significant factor in the genesis of streptococcal epidemics. The purpose of this report is to describe an outbreak of streptococcal infections, to indicate the clinical characteristics of two hosts who spread contagion and to discuss the nature of infectivity or communicability of Streptococcus hemolyticus.

THE DANGEROUS CARRIER OF HEMOLYTIC STREPTOCOCCUS

There is no consensus on the proper isolation for streptococcal respiratory tract infections (*2*) (*3*) (*4*) (*5*) (*6*). It is customary, at present, to isolate patients with scarlet fever for 3 weeks and not to isolate individuals with streptococcal throat infections who fail to develop an erythematous rash. This condition exists although it is well recognized that both groups of patients may be infected with identical strains of hemolytic streptococcus, the host's skin sensitivity to erythrogenic toxin and perhaps the amount of toxin produced in vivo being the only differences. It is recognized also that a large percentage of patients of both groups carry hemolytic streptococcus in their throat flora for several weeks after recovery without giving rise to return cases (*3*).

In previous studies at a New York hospital, the author observed 50 scarlatinal patients whose throat cultures contained the infecting strain of hemolytic streptococcus at the time of their discharge.

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Forty-nine of these failed to give rise to return cases; they remained *harmless* carriers. One patient, however, who clinically appeared to be recovered, infected 4 members of his immediate family on returning home. This individual became a *dangerous* carrier for an undetermined period after recovery from the acute illness.

Such an individual usually escapes recognition, and it is this fact that confounds all attempts to develop a rational scheme for preventing the spread of streptococcal infections. The organisms from the dangerous carrier have shown no cultural or serologic differences from those of the harmless carrier. And yet the interaction of host and microorganism in the dangerous carrier results in the development of a bacterial strain with great infectivity for the human respiratory tract. It is this interaction which appears to be an important factor in the subsequent spreading of contagion and which is the subject of the present analysis.

CLINICAL DESCRIPTION OF TWO DANGEROUS CARRIERS OF HEMOLYTIC STREPTOCOCCUS

In October 1942, when the carrier rate for hemolytic streptococcus was low in New York City, an epidemic of throat infections began in a naval training center situated in that city (*7*). During the next 3 months the author received at the Brooklyn Naval Hospital about 200 of these patients with throat infections caused by hemolytic streptococcus Group A, type 19.[1] The clinical diagnoses were scarlet fever, acute pharyngitis, or acute tonsillitis depending upon the presence or absence of an erythematous rash and the presence or absence of evident tonisllar tissue. Complications were mild and rare; there was no mortality. It was not until late in the epidemic that the microorganism developed invasiveness and gave rise to several cases of mastoiditis, pneumonia, and empyema. However throughout the epidemic this strain of type 19 manifested its capacity to induce a scarlatiniform rash in susceptible individuals and to produce a high concentration of erythrogenic toxin[2] (40,000 S. T. D. per cc. of filtrate) in vitro.

The fact that this type-19 strain was spreading steadily at the training center suggested that this organism was highly communicable and the first cases admitted to the hospital were cautiously isolated in cubicles. However with the rapid increase in admissions, isolation facilities were soon exhausted and aseptic technics were abandoned. All of the patients were admitted within the first 24 hours of illness.

[1] Typing of the hemolytic streptococci recovered from these patients was done by Lt. Robert F. Watson (MC) U. S. N. R. at the hospital of the Rockefeller Institute for Medical Research. The author is indebted to him for this valuable assistance.

[2] The toxigenic activities of three type-19 cultures were determined by the State of New York Department of Health through the courtesy of Miss Julia M. Coffey.

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were treated symptomatically without sulfonamides in most instances, and were kept in bed from 2 to 3 weeks. Their care between October and February involved close association with approximately 30 nurses and 200 corpsmen. In spite of the fact that the wards were overcrowded to double their normal capacity and that an aseptic technic was not possible, only 4 nurses and 5 corpsmen contracted the epidemic type-19 infection from these acutely ill and convalescent men.

It is not known how many of these patients carried type-19 hemolytic streptococcus in their throat flora on return to duty after 3 weeks' hospitalization, nor is it known whether any of the convalescent patients gave rise to cross-infections on the contagious disease wards or if any returned subsequently as patients. It is known, however, that two individuals became dangerous carriers and disseminated contagion after they had been returned to duty. They will be described as patients A and B.

CLINICAL HISTORIES OF PATIENTS A AND B

These two seamen were both admitted to the sick list during December 1942. Both had type 19 hemolytic streptococcal throat infections. Their histories are briefly as follows:

Patient A was admitted to the hospital with an acute pharyngitis. He did not develop a rash but during the second week in the hospital complained of an earache. No signs of otitis were detected and the patient was treated symptomatically. Three weeks after admission he appeared to have recovered and was returned to duty. Ten days later, however, he was readmitted to the hospital with symptoms and signs of mastoiditis. Mastoidectomy was performed on the Ear, Nose, and Throat Service. Bacteriologic examination of the pus from the operative wound showed Streptococcus hemolyticus type 19 in almost pure culture. Recovery from mastoidectomy was satisfactory; however the patient remained pale, failed to gain weight, and complained of a hacking, nonproductive cough.

Roentgenograms of the lungs showed evidence of bronchitis in both lower lobes and films of the sinuses showed thickening of the mucous membrane lining of the maxillary sinuses. The throat flora contained a small percentage of hemolytic streptococcus type 19.

The ear, nose, and throat ward, on which patient A was admitted, had been free of cross-infections until 10 days after his arrival. In the following 2 weeks, four bed patients contracted scarlet fever or acute pharyngitis. In each case the predominating organism in the throat flora was hemolytic streptococcus type 19. Patient A was then removed from this ward and no other cross-infections occurred.

Patient B was admitted to the hospital with the classical clinical picture of scarlet fever. He was treated with sulfathiazole, 8 gm. daily for 5 days and then 4 gm. daily for 8 days. The temperature reached normal on the fifth day of chemotherapy. Twenty-two days after admission he appeared in good health and was returned to duty. However 2 days later this man developed a severe

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headache and fainted, falling to the floor and striking his head. Because of the possibility of a cranial injury, he was readmitted to the hospital and was placed on an orthopedic ward. Symptoms referable to a head injury rapidly disappeared, but the patient looked pale and complained of weakness. He failed to regain weight and was distressed with a hacking, nonproductive cough.

Serial x-ray films were similar to those of patient A. They illustrated the changes observed during the period in which the spreading of contagion was recognized. These findings are summarized briefly as follows:

9 February 1943.—Chest: A minimal diffuse exudative infiltration is present in the left lower lobe. Sinuses: There is moderate thickening of the mucous membrane lining of both antra; other sinuses are clear and well aerated.

2 March 1943.—Chest: Slight resolution of the infiltration at the left base has occurred. Sinuses: Very little change has occurred in the sinuses since the last examination.

22 March 1943.—Chest: The infiltration at the left base is almost, but not completely, resolved. Sinuses: All the sinuses are now clear and well aerated with no longer any thickening of the mucous membrane lining visible anywhere.

The arrival of patient B on this ward was followed by a severe outbreak of streptococcal infections, type 19.

DESCRIPTION OF STREPTOCOCCAL OUTBREAK ON ORTHOPEDIC WARD

On 31 December 1942, when patient B was readmitted to the hospital, the orthopedic ward contained 40 bed-patients. It had been free of streptococcal infections and there had been no contact between this ward and the patients or personnel of the contagious disease service. Following the arrival of patient B on the orthopedic ward an epidemic of type-19 infections occurred as is shown in table 1.

TABLE 1.—*Streptococcal outbreak traceable to patient B*

Date	Case No.	Diagnosis	Infectious agents in throat culture
4 Jan. 1943	1	Scarlet fever	Hemolytic streptococcus group A type 19.
9 Jan. 1943	2	do	Do.
12 Jan. 1943	3	Pharyngitis, acute	Do.
12 Jan. 1943	4	do	Do.
13 Jan. 1943	5	do	Do.
14 Jan. 1943	6	do	Do.
15 Jan. 1943	7	Tonsillitis, acute	Do.
18 Jan. 1943	8	Scarlet fever	Do.
19 Jan. 1943	9	Pharyngitis, acute	Do.
19 Jan. 1943	10	do	Do.
21 Jan. 1943	11	do	Do.
22 Jan. 1943	12	do	Do.
23 Jan. 1943	13	Scarlet fever	Do.
1 Feb. 1943	14	Pharyngitis, acute	Do.
3 Feb. 1943	15	do	Do.
4 Feb. 1943	16	do	Do.

It is seen in table 1 that no infections occurred between 23 January and 1 February. Patient B was given leave for convalescence during the last 2 weeks of January. When questioned on his return, he reported that two families whom he had visited while on leave developed throat infections just prior to the expiration of his leave.

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While patient B was away on leave the entire ward was examined and 2 throat cultures were obtained from all patients and personnel. Five patients and 1 nurse had hemolytic streptococcus, type 19, in their throat flora. However, the ward escaped acute infections until the return of patient B, when 3 more infections occurred. Patient B was then removed to the contagious disease service. At this time 10 of the orthopedic patients who had been transferred to the contagious disease ward at the onset of their acute infections were again placed on the orthopedic ward. They had recovered clinically, but most of them still carried type-19 hemolytic streptococcus in their throat flora. Although new orthopedic patients were also admitted to the orthopedic ward, no other infections occurred during the following 3 weeks, at the end of which this study was terminated.

It has been pointed out that patient B, although treated with sulfathiazole during his acute illness, became a dangerous carrier a few weeks later. To determine whether the carrier state could be modified by sulfonamide therapy he was given sulfadiazine, 8 gm. daily for 11 days. During this period his cough disappeared; the sinuses revealed little change; however, roentgenograms of the lungs showed slight resolution of the process in the left lower lobe. Three days after sulfadiazine therapy was instituted the throat cultures contained type 19, although three subsequent cultures obtained in the next 10 days were negative for hemolytic streptococcus. These were the first negative cultures obtained from this individual since the onset of the acute infection. No cross-infections occurred and it appeared that this course of sulfadiazine therapy had been effective. Patient B was then assigned to work in a ward pantry with a corpsman. This was the only other individual working in the pantry, and he had had no contact with the wards. Nine days later the throat culture of patient B again contained hemolytic streptococcus type 19. At this time the healthy corpsman contracted scarlet fever, and hemolytic streptococcus type 19 was found to be the predominating organism in his throat flora. Following this, patient B was removed from the pantry and placed in isolation. Two weeks later x-ray studies showed clearing of the sinuses and resolution of the process in the lung. The patient recovered completely and no further infections occurred.

It is well recognized that sulfonamide treatment does not change the throat flora of the harmless streptococcal carrier but it has not been known what effect sulfonamide may have on a respiratory pathogen in the dangerous carrier. In patient B it appeared that the dangerous carrier state was modified by sulfadiazine, but only while sulfadiazine was present in the blood. If further studies confirm this observation, prolonged sulfonamide treatment of dangerous carriers can be made a simple and effective means of interrupting the epidemic process.

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OBSERVATIONS ON THE TYPE-19 ORGANISMS OBTAINED FROM DANGEROUS CARRIERS

The type-19 organism associated with this epidemic was a typical beta hemolytic streptococcus which formed matt colonies on blood agar plates. Its capacity to produce erythrogenic toxin was well developed; however it was not highly invasive. Judged by its over-all effect on man it was not considered to be an unusually virulent[3] strain. Its communicability was its most striking characteristic.

The throat cultures of patients A and B were consistently positive for type 19 during the period that contagion was spread. However the number of colonies of hemolytic stretococcus observed on blood agar plates was always small. Morphologically these colonies were indistinguishable from the organisms of acutely ill patients and harmless carriers. Previous studies (*1*) had suggested that bacterial dissociation might be an important factor in determining communicability and that a strain might produce highly communicable, nonhemolytic variants. In the present study, however, facilities were not available to determine whether the type-19 organisms obtained from these dangerous carriers were undergoing dissociation or whether variants were present in their throat flora.

Attempts to transmit this streptococcal infection of patients A and B were made on two occasions. Throat washings from both patients containing type-19 organisms were instilled in the nasopharynx of ferrets. The animals, however, did not contract streptococcal infections.

DISCUSSION

The author has previously pointed out (*9*) that one of the five conditions favorable to the development of a streptococcal outbreak is the presence of a highly communicable microorganism. The host harbor-

[3] It is important that the student of streptococcal infections avoid the confusion that the term *virulence* causes among clinicians. Virulence is considered by the bacteriologist as the degree of disease-producing power after implantation has occurred. It is a measurement of the over-all effect of the microorganism on animal tissues. In the case of Streptococcus hemolyticus, one strain may be considered virulent for man because it is highly invasive and causes bacteremia; another because it produces a powerful erythrogenic toxin and causes intense scarlatina; still others, because one or more of their cellular constituents produce a severe febrile reaction and collapse of the host. Such a highly virulent organism may have an extremely low degree of communicability; and the converse is also true, for a highly communicable organism may produce little or no evidence of disease in man and, by definition, be avirulent. In the opinion of the author, virulence of hemolytic streptococcus should be visualized as a mosaic comprising all the functions of the bacterium which incites disease; whereas communicability is the capacity of the air-borne organism to implant itself in the human nasopharynx. It is essential for clear thinking that the epidemiologist recognize the fact that: (*a*) *Virulence,* the over-all capacity to produce disease, and (*b*) communicability, the capacity to grow readily when transplanted to the respiratory tract, are independent functions of the streptococcal cell. The presence of both of these functions is characteristic of an epidemic strain of Streptococcus hemolyticus.

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ing such an organism is a dangerous carrier who may initiate and perpetuate a streptococcal epidemic. The acquisition of communicability by the bacterium can occur under two conditions: (a) During a secondary streptococcal infection, such as sinusitis or bronchitis, and (b) during an outbreak of virus infections of the respiratory tract, such as measles, the "common cold", or influenza (*10*).

Students of infectious diseases have repeatedly emphasized the coincidence of secondary streptococcal infections and the development of the dangerous carrier state (*3*) (*11*) (*12*). In this investigation it was observed that patients A and B had apparently recovered from their acute infections but had failed to regain weight lost during their febrile illness. Both had a nonproductive, hacking cough. Both had roentgenographic changes in the maxillary sinuses and bronchial tree indicating persistent infection. Both had normal appearing throats, the flora of which contained a few colonies of this epidemic type-19 hemolytic streptococcus. Both spread contagion until 3 months after the onset of their disease when the abnormal x-ray findings in the sinuses and lungs disappeared. Both had subacute respiratory tract diseases and remained dangerous carriers until their infectious processes subsided. The present study again indicated that the acquisition of communicability can occur during a secondary streptococcal infection and that the maintenance of this acquired function of the organism depends upon an active disease process. The mechanism responsible for this enhanced communicability is unknown. The following hypothesis is presented with the hope that it may interest others to investigate this important function of the streptococcal cell.

Hemolytic streptococcus is one of the most prevalent air-borne respiratory pathogens. When inhaled into the nasopharynx, the organism usually succumbs; it is, in general, not highly communicable. Certain strains, however, have great capacity for initiating and perpetuating a respiratory outbreak. The genesis of such an outbreak of respiratory tract infections is determined by the capacity of the bacterium to reproduce rapidly in the presence of the inhibitory substances of the human nasopharynx. The acquisition of this capacity or property by the bacterial cell is conditioned by the interaction of the infected host and the microorganism. If either the host or the respiratory pathogen establishes its supremacy with dispatch, it is unlikely that this capacity will develop. If, however, the host is unable to terminate the disease process and the bacterium is unable to extend its invasion, a series of changes may occur in the bacterial cell. Under these conditions of continued, mild, subacute disease, the microorganism is forced to adapt itself to the changing immune state of the host in order to maintain its activity. In making these adaptations to factors within the host, the microorganism gives rise to bacterial cells

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endowed with the capacity to multiply in the presence of the inhibitory substances of the normal mucous membranes. The acquisition of this capacity by these cells permits them to survive when transmitted to the nasopharynx of a new host. These cells have thereby acquired communicability; they are "host-fast." This acquisition is not permanent;[4] it is soon lost in the newly infected host and is also lost in the host spreading contagion as soon as the peculiar interaction ceases.

There is as yet no answer to the most important question: What is the mechanism by which the streptococcal cell acquires communicability? This is the key problem in the epidemiology of Streptococcus hemolyticus. At present one can justly emphasize the fact that the potential of a bacterium is modified by the presence of substrates in the medium to which the organism must adapt itself, and can indicate how adaptive mechanisms may permit the acquisition of communicability by the streptococcal cell. For example Lancefield's (*14*) studies have shown that there is an intimate association between the group specific carbohydrate of hemolytic streptococcus and the animal species for which the organism is infective. It is not known whether pathogenicity is determined by similar differences in capacity for synthesis. However, there is sound experimental and clinical evidence demonstrating that hemolytic streptococcus may adapt itself to an unfavorable medium by developing methods for synthesis which are ordinarily not manifest. It has been shown that some strains of hemolytic streptococcus, when grown in a medium containing sulfonamide, acquire the capacity to synthesize para-aminobenzoic acid[5] and thereby are able to multiply in the presence of concentrations of sulfonamide which are ordinarily bacteriostatic. This new property of sulfonamide fastness seems to be stable in subcultures. However, not all newly acquired mechanisms for synthesis are stable (*16*) (*17*) (*18*) (*19*). Some are lost when the organism finds itself in a medium lacking the substrate which specifically induced its newly acquired function. And from the observations presented in this report it appears that the mechanism of communicability may be of such a nature. The indications are that biologic adaptation by hemolytic streptococcus may depend on the development of adaptive enzyme systems, such as those associated with Spreading Factor (*20*) (*21*).

In conclusion, the stimulus that initiates the development of the cellular systems prerequisite for communicability appears to be active

[4] Schwentker has recently stated: "Obviously, the more organisms of any type there are in the population group, the greater the chance of contracting a disease due to this type. Since the fluctuations in distribution of various strains in any locality are apparently unrelated to one another, it is probable that they are not caused by environmental conditions which would be common to them all. Instead, it seems that the ability of an organism to become distributed throughout a community is an intrinsic, although perhaps temporary, characteristic of the strain" (*13*).

[5] Following the postulates of Woods (*15*), several investigators, including the author, have trained the bacterium to synthesize para-aminobenzoic acid.

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both in the host with a virus disease of the respiratory tract and also in the host with a secondary streptococcal infection. It is, therefore, of some interest that there is possibly a common denominator between these two hosts. The nasopharyngeal mucous membrane of the former harbors virus particles; and one component, common to all of the viruses that have been purified, is nucleic acid, either desoxy-ribose or the yeast-nucleic type (*22*) (*23*) (*24*). The host-bacterium relations in the latter are comparable to those created by Griffith in the subcutaneous tissues of the mouse. In his classical studies, Griffith (*25*) demonstrated that living pneumococci, when placed along with heat-killed cells in a nidus where they multiply unchecked by the inhibitory action of a healthy mucous membrane, undergo reversion from avirulence to virulence and a transformation of type. Avery (*26*) has recently identified the transforming substance of the killed pneumococcal cells as desoxy-ribose nucleic acid. The possibility that some substance common to viral particles and bacterial cells may modify the metabolism of Streptococcus hemolyticus is subject to experimental attack. The nexus between a host-bacterium interaction and the acquisition of communicability by the streptococcal cell can probably best be defined by the collaboration of the clinical epidemiologist, the student of bacterial metabolism and the enzyme chemist.

SUMMARY

1. Observations made on about 200 individuals with scarlet fever or acute pharyngitis caused by hemolytic streptococcus, group A type 19, indicated that contagion was spread only in rare instances either during the acute illness or in convalescence.

2. Two individuals of this group, who had been discharged from the hospital, later gave rise to outbreaks of type-19 streptococcal infections. These individuals had become dangerous carriers.

3. Unlike the harmless carriers of the epidemic strain who did not spread contagion, these two individuals manifested symptoms and signs of mild, subacute disease processes of the respiratory tract without fever.

4. There appeared to be a close relationship between the persistence of these mild infections and the capacity of these individuals to spread contagion.

5. It is suggested that:

(*a*) Streptococcal epidemics are initiated and perpetuated by individuals disseminating bacterial cells endowed with great infectivity or communicability.

(*b*) This function of the streptococcal cell is derived from the interaction of the host and respiratory pathogen.

(*c*) During this interaction, the pathogen is modified and gives rise to organisms which are "host-fast."

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(*d*) When inhaled, these organisms multiply readily in the presence of the inhibitory substances of the human nasopharynx.

6. These observations indicate that individuals who develop sinusitis, bronchitis or other subacute infections following recovery from acute streptococcal throat infections are potentially dangerous carriers.

7. The simple and apparently effective method of breaking the epidemic process by treating dangerous carriers of hemolytic streptococcus with sulfonamide is recommended.

The author feels deeply indebted to the late Fred Griffith of the British Ministry of Health. His studies made possible this investigation of the epidemic process of Streptococcus hemolyticus.

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PYROGENIC REACTIONS TO PARENTERAL FLUID

Pyrogenic reactions are by far the most common and may occur after the intravenous administration of any fluid which has been improperly prepared or administered with improperly prepared apparatus. Pyrogens, strictly speaking, are any substances which will provoke a febrile reaction after intravenous administration. Pyrogens are usually the product of bacterial growth and disintegration of bacterial bodies—certain bacteria, particularly gram-negative varieties, produce more pyrogens than others. The presence of pyrogens in poorly prepared or poorly preserved distilled water and the ease with which glassware and apparatus become contaminated explain the relative frequency of pyrogenic reactions. In addition, blood plasma and serum are relatively good media for bacterial growth, and a minimal chance contamination may be followed by bacterial growth sufficient to cause extremely severe reactions, when the material is used intravenously.

Fresh properly distilled water is pyrogen-free and is often referred to as "parenteral." If distilled water contains pyrogens, it is usually due to one of three causes. First, the still or the container, used to collect the distillate is contaminated. Second, the still is not properly constructed, so that droplets of water are entrained with the current of steam and carry pyrogens with them. Third, the water may be perfectly distilled but allowed to stand for several hours before sterilization so that bacterial contamination occurs. In addition, if the original water is heavily contaminated, the distillate is more likely to contain pyrogens.—Strumia, M. M.; McGraw, J. J.; and Blake, A.: Reactions to parenteral fluid administration. Ann. Int. Med. 19: 718–719, November 1943.

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LYMPHANGITIS OF SUSPECTED FILARIAL ORIGIN

A PRELIMINARY REPORT CONCERNING ITS TREATMENT

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Filariasis always has been a rare disease among naval personnel. Undoubtedly, its rarity has been coupled with the comparatively good protection from mosquitoes afforded the men during peacetime occupation of areas where filariasis was common. In this war, many have been living in these areas under conditions similar to those of the native population and, as a result, the incidence of the disease in white personnel has become alarmingly high.

When a group of patients with suspected filariasis arrived at this hospital, the situation was considered sufficiently important to appoint a special commission to investigate the disease. The duties of this commission were to study possible new forms of treatment and to determine, from the standpoint of the Navy, the best disposition of these patients.

Most of the 46 cases received at this hospital were Marines from the South Pacific area. Their admission diagnosis was lymphangitis. Great credit must be given to Lt. Comdr. R. H. Fogel (MC) U. S. N. R. who first observed these cases. He originally believed them to be of filarial origin and so diagnosed some of the early cases, but because the adult worm or microfilaria could not be demonstrated the diagnosis lymphangitis was correctly applied.[1]

Because of the rarity of filariasis in white men and because naval personnel stationed in the same area in former years had not developed the disease, a careful analysis of all data pertaining to it was collected from the patients.

[1] Since submitting this paper, a biopsy from the left midforearm of one of our recent patients has revealed the adult gravid female filarial worm. This we believe is sufficient proof to establish these cases of lymphangitis as filarial in origin.

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LENGTH OF DUTY IN THE ISLANDS.

In the group of 46 patients the time interval between possible exposure and the onset of symptoms varied from 3 months to 21½ months. These figures are interesting because heretofore it was believed that white persons would not develop the disease until they had been 2 years in the islands. Another interesting and perhaps significant fact is that all the patients in this group developed their symptoms in the fall months, from September to December, regardless of the length of time exposed.

LOCATION OF MEN ON THE ISLANDS.

As already mentioned naval personnel in this region in former years had been protected from mosquitoes by proper shelter and netting. Activities and quarters were confined largely to the region of beaches. This is the first time that our personnel has been exposed unprotected and under conditions similar to that of the native population. While symptoms developed in some men whose activities were confined to beach positions the large majority of the cases occurred in men who worked inland in the brush and jungles.

SYMPTOMS AND PHYSICAL FINDINGS.

The symptoms and physical findings in the original attack of the disease appeared to differ in no way from those encountered during recurrences. The areas most commonly involved in order of frequency, were as follows:

1. The spermatic cord, epididymis and testicle.
2. The upper extremities (most commonly the forearms).
3. Thighs and popliteal spaces.
4. Upper eyelids.
5. The scrotal sac.

The onset of most attacks usually occurred at night when the patient often would be awakened with a sharp drawing pain in the region involved. In only a few instances were the attacks accompanied by fever and then only of a mild degree and of very short duration. Symptoms, as a rule, were confined to the particular region involved.

When the scrotal contents were involved the first complaint was that of soreness and tenderness affecting one testicle, rarely both. Swelling developed and concurrent with the swelling many noticed "lumps" in the inguinal regions. The soreness and tenderness would subside in 3 or 4 days, leaving a residual local swelling of the spermatic cord or testicle and lymphatic enlargement of varying degrees.

In the extremities various manifestations were present. In some there was tenderness and swelling of the lymph nodes followed by red streaking which progressed distally. In others small knots or elongated "lumps" were observed along the borders of muscles and

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along vessel paths. These were tender and overlying redness was occasionally observed. In other instances the patient complained of a localized fullness or swelling of the soft parts, particularly just below the elbow on the mesial aspect of the forearm. These areas were often difficult to palpate but careful comparison with the uninvolved side revealed a sensation of diffuse thickening of the subcutaneous tissue, usually associated with tenderness and slight enlargement of the lymph nodes draining the area. Another manifestation suggested an allergic phenomenon in which typical varying sized wheals would develop on an extremity and become very itchy. It is interesting that the wheal usually was well developed before much itching occurred and seldom remained longer than a few hours. One especially observant corpsman said that the wheals usually antedated a diffuse swelling of the same area by about 3 days, although we could not confirm this observation. In one case only the fingers were involved in an attack, while in another attack the fingers remained normal and the swelling was confined to the volar and dorsal surfaces of the hands.

In none of these cases was so-called "elephantiasis" present but upon arrival in this country many had residual swelling in the spermatic cord, epididymides, legs, and forearms. Nearly all had lymphadenopathy of varying degrees.

Many patients had had but a single attack, and since it was important to determine their fitness for duty, they were divided into two groups. One group consisted of patients who had had only one attack or had been symptom free for several weeks. The other group consisted of patients with an active attack or a subsiding recent attack. Group 1 was placed on outside duty involving considerable physical exercise, drill and field exercises. Group 2 was placed on light duty, serving as hospital messengers, clerks, etc. In group 1 all but a few of the patients had recurrent swelling and pain in the previously involved areas. Those that did not have recurrence were those who had had very little original involvement and no residual involvement on arrival in this country. In group 2 there were few recurrences, but this same group when placed on outside duty soon developed recurrences. It is interesting that these were almost all in the region of the original involvement. Eosinophilia was marked in nearly all cases during the recurrences but at no time could microfilariae be demonstrated.

PATHOLOGIC CHANGES.

In none of the cases were microfilariae demonstrated in the blood stream prior to admission here or subsequently. In the majority of these cases Dirofilaria immitis skin test for filaria had been done in the islands and reported as positive in 16 cases. The eosinophil counts

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taken while the patients were in the islands varied from 3 to 32 percent. When the patients arrived here with subsiding symptoms the eosinophil count varied from 1 to 27 percent. From 1 patient hydrocele fluid was examined for microfilaria with negative results. Biopsies of 3 lymph nodes and 3 lymph channels have not revealed adult worms or microfilariae. The lymph nodes revealed an increase of reticulo-endothelial cells, but this condition may be seen in any node which has reacted to a toxic substance. Therefore the laboratory data, as a diagnostic aid, was practically useless. Our only support for the diagnosis of filariasis was the clinical and physical findings.

After this study was begun we received a patient from the Naval Hospital at Oakland, Calif., who was originally from the same island and who had symptoms identical with those of our own patients. At that hospital the pathologist had found, in a biopsy of a lymph channel from the right wrist of this patient, the adult gravid female filaria. This, of course, is very positive proof of the diagnosis and we believe that one can assume that all of these cases are of the same order in spite of negative laboratory data.

TREATMENT.

Chemotherapy.—There is no known specific drug for the treatment of Wuchereria bancrofti infection and none is known that will destroy the parasites during the life of the human host.

Many forms of chemical substances have been advocated as helpful in the treatment of this disease. In a recent study Hawking (*1*) reports that fouadin, lithium antimony thiomolate, acetylarsan, espundal, tartar emetic, neoarsphenamine, and sulfanilamide are of no value. Earle (*2*) however did find that sulfapyridine was of value in treatment of lymphadenitis and cellulitis complicating elephantiasis. In another report Earle (*3*) observed that 2 sulfanilyl-aminopyridine when given in 2-gm. doses by mouth had a marked effect on the fever and general symptoms associated with lymphangitis and lymphadenitis but no effect on the microfilaria.

Many of the patients in our group received, at the onset of their disease, one of the sulfonamide drugs. No startling effects were noted. Similar therapy employed at this hospital during recurrent attacks has been without effect.

Surgical.—Surgical procedures are of great value in the treatment of elephantiasis. In these early cases however, because of the resultant scar and possible interference with lymph drainage, it was felt that surgery was contraindicated. Therefore biopsy studies were very few in number.

X-ray therapy.—Reticulo-endothelial hyperplasia is a common finding in filarial infection. Because of the well-known effect of x-ray on reticulo-endothelial tissue, it was thought that such therapy over the enlarged lymph nodes might reduce the swelling and facilitate

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drainage of the lymph channels. Accordingly, moderate voltage (140 kv.) x-ray therapy was administered unilaterally to the lymph nodes of a group of patients who had bilateral involvement. The radiated glands promptly receded in size. Following the x-ray treatments these patients were put on outside duty to determine the effect of x-ray on any possible recurrence. After a period of observation these patients developed recurrences on the untreated side and reduced or no recurrences on the treated side. Encouraged by these results we have used x-ray treatment on all patients who have had recurrences or a residual adenopathy.[2] Experience with the first group of patients indicated a more prompt response to copper filtered radiation than to aluminum filtration and accordingly the subsequent cases were treated with 140 kv., 15 ma., 50 cm. TSD, aluminum 1 mm., copper ¼ mm. administered in doses of 105 r units every other day giving a total of 315 r units including backscatter to each area. Most of the patients who had received x-ray treatment were then given a 30-day leave to enable them to obtain the full effect of the treatments. They have now returned from their leave and have been assigned to hard labor on the outside for a period of from 4 to 6 weeks. It is hoped that if recurrences are to appear they will occur during this period. A subsequent report will be made at the conclusion of this investigation.

SUMMARY

This preliminary report on a group of lymphangitis cases of suspected filarial origin includes our clinical and pathologic findings, and methods of treatment. A form of treatment with x-ray is reported: the results of this treatment to date have been encouraging but the report on the final results will be published at a later date.

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[2] NOTE.—At the time this preliminary report was completed, we were not familiar with the excellent original observations concerning the roentgen treatment of filariasis as reported by Golden, R., and O'Connor, F. W., in the Transactions of The Royal Society of Tropical Medicine and Hygiene 27: No. 4, pp. 385–398, 1934.

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INCIDENCE OF FILARIASIS IN CHILDREN

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It has been convincingly demonstrated that the white man's "immunity" to filarial infections in the tropics is merely a lack of exposure to infecting insects. His manner of living within screened houses has contributed not a little to this protection. However, with the present wide dissemination of troops into tropical areas where they must frequently live in the open, conditions and frequency of exposure to insects are not unlike those of the natives. It is therefore particularly interesting to note the incidence of filarial infection among native children of lower age groups, with the view that such a survey might serve as a rough indication of the time of exposure necessary for a filarial infection to become discernible, and yield significant information with regard to the disease expectancy of exposed troops.

A survey was accordingly conducted among the native population of a South Pacific Island where endemic Wuchereria bancrofti infection with elephantiasis manifestations is common. Infants, children, and adults were included. Of 201 cases in which peripheral blood wet smears were examined microscopically, 15.9 percent showed positive infection with microfilariae. In agreement with common findings elsewhere, the percentage of positive findings was very low up to the age of 20 years. The greatest incidence was found in the 20- to 35-year group. Males were more frequently infected than females in a ratio of 2:1 (21.8 percent to 10 percent). The most striking finding was that of microfilarial infection in one child 2 years of age and in another 3 years 3 months of age.

It has been noted by various observers (*1*) (*2*) (*3*) that the appearance of the microfilariae in the peripheral blood in the South Pacific does not show the periodicity common in most other endemic regions of the globe (India, Africa, Puerto Rico). Actual elephantiasis with lymph stasis and enlargement of appendages was seen in only a few instances, 18 years being the youngest age at which such a manifestation was observed. The elephantiasis was of varied patterns involving one or both lower extremities, the scrotum, or, as in one instance, upper and lower extremities bilaterally.

The two youngest infected patients seen were: (1) A child 2 years old (in whom the presence of numerous microfilariae in the peripheral

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blood was the only abnormal finding) and (2) a child 3 years 3 months old. The wet smear of the peripheral blood of this child showed heavy infestation with microfilariae, and in addition there was a 4-plus Kahn reaction. This child had been sickly all her life, walking and speaking but little. She had been subject to frequent febrile episodes associated with numerous ulcerative body lesions which left dark circular scars when healed. It was felt that her physical incapacity was the result of concurrent yaws.

These two children presented evidence of early filarial infection. In view of this apparent epidemicity, routine tests for filarial infection were carried out on naval personnel who had spent 9 months in this area. Results however were entirely negative at that time.

The youngest patient with bancroftosis reported in the literature of the past 13 years is that of a child 14 months of age (*4*). Included in this report from British Guiana were 3 other instances of infection in children under the age of 2 years. However Sweet and Pillai (*5*) recorded Filaria malayi infection in India in 1 child under 1 year of age, in 2 of the age of 1 year, in 8 children of 2 years, and in 10 of 3 years. Thus it is seen that rapid, early appearance of filarial infection is quite possible.

Iyengar (*6*), in Travancore, observed bancrofti infections in 2 children 2 years and 3 months, and 2 years and 4 months old respectively. In Shertalai, he observed Filaria malayi infection in 4 children aged 2 years, in 9 aged 3 years, and in 17 children aged 4 years. He found here an incidence of 18.9 percent infection with Filaria malayi among the children between the ages of 1 and 5 years. Rao (*7*), working in Pātnagarh (India), found the youngest infected individual among 1,047 persons to be a child of 4 years with a Filaria malayi infection.

The relative percentage of infection in the lower age group is, of course, small. Especially with bancroftosis, infection may be regarded as exceptional under 10 years of age (*8*); however, it remains a distinct possibility. In Puerto Rico, Hoffman and his associates (*9*) found 5 years the earliest age at which microfilariae were seen. In extensive surveys on this same island, O'Connor and Hulse (*10*) found the youngest infected child to be 3 years of age.

Hawking (*11*), in Tanganyika, reported the youngest patient in whom a positive infection was encountered to be a girl 6 years of age. O'Connor (*1*), in Samoa, surveyed 4,294 natives and found positive infections among 5-year-old children, but unfortunately he did not include younger children in his investigation. However, in the Ellice Islands he surveyed 1,417 natives living on 8 atolls and found a positive infection in a lad 4 years old. In the Tokelau Islands, among 330 people, he found 1 youngster of 4 years to be infected.

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SUMMARY

1. In a survey of 201 natives of a South Pacific Island, one child of 2 years and another of 3 years 3 months were found to be infected with Filaria bancrofti.

2. In similar surveys by other investigators, the earliest case of bancroftosis reported occurred in a child 14 months of age living in British Guiana. A child less than 1 year of age infected with Filaria malayi was reported from India.

3. With the present greater exposure of troops to infection in the tropics, the possibility of an early filarial infection should be borne in mind by medical officers, and periodic checks should be made among personnel if early and intelligent control over the disease is to be maintained.

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FATIGUE

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Once a chronic type of emotional illness is established, return to active duty is contraindicated. This policy is based on previous war experience. It is recognized, however, that any well adjusted individual, subjected to severe physical and emotional strain may become temporarily ill. At the same time he may be a desirable individual for retention in the Naval service.

One of the most commonly encountered symptoms in all diseases is fatigue. It is especially prominent in personality disorders. The understanding of this symptom is essential for the proper differentiation of the acute from the chronic types of emotional illness.

The word fatigue, although universal in medicine, has a different meaning to every physician. In Webster's dictionary the definition is brief, concise and practical: "Fatigue is the loss of power due to continued work, but removable by rest." With this as a foundation it is essential to review fatigue as seen in medical practice. Judged from its presence in various scopes of medical sciences, fatigue is a vague term. Throughout the years it has been a problem for investigation in medical research. To some physicians fatigue is a disease entity. To others, it is considered a symptom of a disease. Psychologists stress the biochemical products influencing the metabolism of the central nervous system. Psychiatrists, dealing with the personality responses, express many theories as to its production. Muncie (*1*) quotes Dill as saying: "There appears to be little prospect of developing a simple and adequate hypothesis regarding the origin and nature of fatigue." This statement followed long periods of extensive research. It demonstrates the complexity of the problem of fatigue in medicine.

This present study will endeavor to take up fatigue as the total personality responses to work and stress. This would include the subjective symptoms and objective physical signs. The laboratory findings, chemical and physical, cannot be overlooked. Finally the total personality reactive tendencies must be stressed. Each individual, therefore, will vary according to his heredity, constitution and personality responses to life situations.

Most authorities agree that there are two main types of fatigue, the acute and chronic. Unfortunately, they frequently are seen in

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combination, which confuses the total picture. Under the present wartime conditions it is impossible to treat chronic personality disorders in base hospitals. Therefore, this study will emphasize the acute type of fatigue. An attempt to understand the acute without knowledge of the chronic type is impossible. Fatigue in general must be reviewed. All the facts must be analyzed and integrated.

DISCUSSION

Pillsbury (*2*) emphasized the chemical reactions, physiologic changes and the emotions as factors in the production of fatigue. However, an attempt to distinguish between mental and physical fatigue from a personality concept is impossible. McDougall (*3*) felt that fatigue was a state of raised synaptic resistance throughout the nervous system. It is manifested by subjective symptoms and objective signs. He and Hollingworth (*4*), using the same test object, recorded experimentally opposite results. Certain alterations occur normally while observing an ambiguous object. Fatigue produced a retardation and an acceleration of the rate of alterations. This might be explained by the individual personality response to the experiment. McFarland (*5*) in his studies on pilot fatigue in aviation found no single cause for this entity. He emphasized the factors associated with flying conditions and the influences of physiological factors as 0_2 etc. upon the organism. He also stressed the emotions from personal conflicts as they affected the pilot's health. Muncie stressed the individual personality response in discussing the normal psychobiology of fatigue. He showed the normal variation in the individual. It is a well known fact that one recovers quickly with rest from great physical effort. Also, prolonged mental stress requires a longer rest period prior to recovery.

Thus it is evident that separation of the various factors in fatigue is a difficult problem. It is due to a combination of many complex reactions representing the total psychobiologic response of the organism to work, mental, physical, and usually in combination. It will vary in each individual according to his personality reactive tendencies. The only way to evaluate its presence is by a complete study of the total personality functions in each case. It is evident that many psychologic, biologic and somatic theories have been formulated. Fatigue, as a psychobiologic reaction, is the only adequate explanation. It is frequently present in civil life. Under the stress of modern war it will occur more easily and readily. In the following an attempt will be made to observe its presence clinically with emphasis on military psychiatry. For practical purposes, fatigue may be divided into the acute and chronic types.

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In the acute type the subjective symptoms of weakness, lassitude and tiredness are usually in harmony with the physical findings on examination. These will vary in each case but are usually those of weight loss, insomnia, dehydration, and other physiologic concomitants. The history will reveal long-continued stress, physical, emotional, or both. Although insidious in its onset, the clinical manifestations will usually begin abruptly. The emotions will be in keeping with the previous personality reactive tendencies and hence will vary. Tension, fear, or anxiety will be outstanding. However, depression, apathy, or other affective responses may be present. Irritability, seclusiveness, lack of interest, or enthusiasm might be the prodromal symptoms.

These reactions might be seen in the following types of personality disorders:

1. Exhaustion syndrome.
2. Depressive reactions of all types. Manic-depressive, tension depressions, situational or any basically affective illness.
3. Acute anxiety states with their closely allied panics.
4. Postinfectious states.
5. Delirious reactions due to infections, drugs, and exhaustion.

This leads to an important topic, the recognition of acute fatigue in these various personality disorders, and decision as to whether or not return to active duty is warranted.

Sargant (*6*) reported interesting observations on the British soldiers at Dunkerque in 1940. He applied the term "exhaustion syndrome." The soldiers had a masklike facies, sallow complexion and a few had a pill-rolling tremor of the hands. There was a history of a long period without food, sleep or rest. Severe physical and emotional stress with long continuous marching had been present. Some were tense and anxious while others were apathetic. Several talked with pressure regarding their harrowing experience. Others were mute and negativistic. In general, their sleep was broken and characterized by terrifying dreams. Many showed the usual findings of weight loss, dehydration, and physical exhaustion. Should this type of reaction come under observation, certain possibilities exist. First, the patient might recover rapidly within a period of 1 to 3 weeks. The previous personality adjustment being satisfactory, with convalescence he could return to active duty. However, should recovery be prolonged, despite his previous personality adjustment, he should not be returned to active duty. The experience of psychiatrists in military and civil practice justifies this disposition. Once a personality substitute reaction has been utilized in a life situation, later in times of stress it is apt to recur. The pattern is like a conditioned reflex, which, once established, occurs more readily and with less strain.

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Depressive fatigue as seen in affective illnesses should not be difficult to recognize. The family history, previous attacks, and present difficulties should be helpful. The mood statement and psychiatric examination should clarify the total picture. In addition, depressive fatigue has certain distinguishing qualities. It is mood determined. There is a lack of initiative with the feeling of sadness. The diurnal variation is characteristic, being worse in the morning and improving as the day progresses. It is partly alleviated by effort and activity. Once this type of fatigue has been established the obvious disposition is not to return the patient to active duty. Gillespie (7) described the anxiety reaction (depressive state) seen in combat. This type usually occurs in obsessive individuals working under severe mental stress. It is frequently observed in officers. The long continued effort in unfamiliar surroundings with new work results in a fatigue reaction. The symptoms and signs as described by Gillespie suggest a chronic type of fatigue reaction. It certainly has many of the characteristics of a depressive illness. However he emphasized the presence of restlessness and apathy more than the depressed mood. In this type of reaction there are present probably features of both acute and chronic fatigue. Should the symptoms and signs prevail following the institution of treatment over a limited period, then the chronic fatigue will be the primary problem. If this is established and confirmed, the individual would not be fit for return to active duty. Delirious reactions with exhaustion resulting from infections and drugs, etc., need individual care and study. The typical syndrome with clouding of consciousness, disorientation, fear and hallucinations, should clear up rapidly with prompt and appropriate treatment. If the review of the previous life adjustment is satisfactory, return to active duty is justifiable. However the chronic types, as seen in hysteria, manic states, and schizophrenic reactions, show evidence of total personality dysfunction. The appropriate disposition in such cases should be as permanently unfit for active duty.

There is a type of fatigue which is quite difficult to evaluate. It is that reaction which follows postinfectious states, especially influenza and pneumonia. A similar phenomenon is the debility seen in hyperthyroidism and brucellosis. In order to determine the disposition of these complicated cases, one would have to evaluate the individual problem. Therefore his life situation, previous adjustments, etc., must be judged according to one's common sense. At the same time, it must be remembered that active duty in the Navy usually implies ability to do any task which he may be called upon to perform, either at sea or on land.

Thus in the acute type one would expect a history of exposure to marked physical and emotional stress. The subjective complaints would be in keeping with the physical findings on examination. The emotions will be in keeping with the previous personality reactive

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tendencies and therefore vary. The onset will be acute, on the surface at least. Most important will be the recovery with a brief period of treatment. The physical condition is primary and the emotional factor is secondary. Possibly a theoretical case illustration might help clarify the issue. Any person under the stress of modern war or combat might be exposed to long and protracted physical and emotional expenditure. In battle conditions, facilities for proper nourishment, rest, and diversion must be unattainable at times. Sufficient quantity of fluids and normal physical hygiene will be absent. The deaths of comrades and other harassing experiences must be distressing to the emotions of the individual. Under such circumstances, one's so-called "resistance threshold" must be quite high to prevent fatigue. This combination in sufficient proportion might produce symptoms and signs of fatigue in any normal person. The physical reactions and total personality responses will be different in each individual.

Certain specific rules must be applied in each case prior to the establishment of acute fatigue as an entity, if return to active duty is made the objective. Three things are essential:

1. There must be a history of prolonged work, physical, mental, or both, with some exposure to severe physical stress.
2. Complete recovery with rest and treatment must take place within several days to 4 weeks at the most.
3. Complete psychiatric studies, including family, and personal history should be made. The personality study and the preceding must show a reasonably well adjusted individual.

Chronic fatigue is a totally different problem. From the standpoint of treatment in the Navy, it is of purely academic interest. In this paper we are concerned with the clinical application to naval psychiatry. Ross (*8*) and Muncie (*9*) state that fatigue of a chronic and disabling sort without any evidence of organic disease must be considered "emotional." This viewpoint is shared by most workers in all fields of medical practice. Symptomatically, the individuals will complain of "being tired." Others will be "exhausted," or "too tired to do anything." At times the only complaint is that "I'm weak." There will be difficulty in beginning, performing, or completing a task adequately. Initiative is paralyzed physically and mentally. At times the desire for work is present; however the somatic motor response is lacking. Ross points to a common observation, the selectivity of this type of reaction. An illustration and common observation of this fact is the ability of these individuals to talk for hours with a physician without effort. Nevertheless, they become exhausted quickly and rapidly while conversing with an emotionally involved parent or relative. The many subjective complaints are not in keeping with the actual physical state observed. Occasionally a state of physical

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exhaustion is observed. However investigation will show that it is secondary and not primary. The long-standing anxiety or tension affects body metabolism. Sleep has been disturbed over a long period. There is altered gastric motility with consequent vascular and secretory disturbances. This leads to gastro-intestinal symptoms and loss of weight. Thus, the actual physical condition observed is indirectly the result of emotional stress.

Followers of some psychiatric schools would probably not agree with many of these explanations. However, the interesting observations of Ross on psychiatric treatment over a number of years are self-explanatory. He found that those individuals who recovered with rest alone actually improved through the efforts of the physician. The psychotherapy on the psychiatrist's part at times was probably unknown to him.

The emotions as a factor in this reaction are stressed by all writers. An excellent military illustration is cited by Ross in World War I. The British soldiers in the retreat from Mons had little food, sleep, or rest for a week. Sufficient fluids and distraction from their plight were inadequate. When finally relieved of their peril, the entire regiment was physically exhausted. With 2 or 3 days of rest, most of the men were able to return to battle. This group had acute fatigue or exhaustion. Another smaller group was never again fit for duty. Their difficulties had their onset prior to the actual physical stress. Interestingly enough, neither group was conscious of fatigue during the actual exposure while furnished with a psychologic objective. However once relieved of the threat of annihilation, the symptoms developed. The chronically disabled group improved with rest, but not totally or completely. For a period psychotherapy seemed to be rehabilitating them. However all improvements seemed to cease with the establishment of the pension system. This system, although humanitarian in chronic personality disorders, is not constructive or conducive to successful treatment. It encourages a parasitic life attitude with regard to ambition, goals, and strivings. Hence the very sense of security it supplies freezes the emotional energy essential for a healthy life. Although necessary and essential in many individuals, it makes psychiatric treatment impossible in a large number of individuals.

Dejerine, as quoted by Ross, gives another example of emotions affecting fatigue. A regiment in a long march requires frequent rest periods because of fatigue. However, when the band suddenly plays martial music, all symptoms of fatigue disappear. This is explained by distracting the troops from their thoughts of family, home, and various conflicts. It also actively attracts their attention and relieves boredom. Chronic fatigue, according to Muncie is a neurotic reaction due to emotionally tinged attitudes. It is the personality dysfunction

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arising from drifting, monotony, boredom, and chronic futility feelings. These individuals, in childhood, are dependent types and continue this attitude throughout life. As adults, their goals and strivings are not attainable. In some the lack of a true life goal makes daily living a monotonous existence. Longitudinal sections of their life chart reveal neither major victories nor defeats. Frequently the same pattern of reaction was present in the parents.

Clinically, chronic fatigue, unlike the acute type, is present in practically all personality disorders:

1. Psychoneuroses of all types, especially those characterized by anxiety.
2. Both phases of affective reactions, especially the depressive types of illness.
3. Many schizophrenic reactions.
4. Practically all illnesses associated with the involutional period.
5. It is a physiologic process with aging, but also an early symtom of cerebral or generalized arteriosclerosis. Thus although more characteristic of some personality disorders, it is present in practically all types of reactions which deal with altered personality function.

This last fact leads to the problem whether or not certain personality types are more susceptible to fatigue in military service. The British psychiatrists (*10*) have made important observations in their experiences. They found that individuals between the third and fourth decade of life and especially those above the fourth decade, fatigue more easily. Therefore they should be studied more closely before enlistment into the armed forces. Again, those subjects whose habitus or constitution is either above or below the average individual had a higher incidence of fatigue and personality disorders. At the same time certain types of men who had suffered many illnesses in the past, irrespective of the nature of the condition, usually proved easy subjects for fatigue. Eventually they were unfit for military service. Another type of person who reacts more readily to fatigue with strain is the obsessive individual. He is above average intelligence, usually passive and inclined to be rigid. In general, he is usually single, somewhat sensitive and timid. This individual is apt to worry and fret to excess. In unfamiliar surroundings with increased responsibility, he finds adjustment to military life rather difficult. In order to accomplish his work in a perfectionistic manner, he really overcompensates. The result of the vicious cycle is an increased susceptibility to fatigue and personality disorders.

Therefore, the emotional difficulties due to lifelong defects in personality functions are characteristic in chronic fatigue. The etiologic factors which might operate are immaterial. From a naval standpoint, the primary object is to eliminate these patients from

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active duty, with their rehabilitation to civilian life a secondary consideration. Prophylaxis at the recruiting stations for all personnel will make an efficient combat force. The physical defects in chronic fatigue are secondary when present, and recovery requires a long period of psychiatric treatment. This is impossible in the present status of naval medicine. Neither the time, facilities, or physicians are available for such a gigantic task.

SUMMARY

Fatigue is usually found to be an accompaniment of all types of disease. It is especially significant in personality disorders. Actually, it is a syndrome which manifests its presence by subjective symptoms and physical signs. The ratio between the two determines the varieties, acute and chronic. The former is characterized by many physical factors and secondary emotional problems. The latter type, in the absence of any organic disease, is always emotional. Hence it follows that the subjective complaints predominate and the physical findings are of lesser importance. It is impossible to group or differentiate either type of fatigue without the study of each individual case. The evaluation of the personality function must include not only the horizontal, but especially the longitudinal cross section of the individual. The total personality must play a role in the production of fatigue. Certain components will seem to play a leading role. However to emphasize the intellectual functions and at the same time avoid the somatic component would be negligence. The emotions, with the resulting conflicts from instinctive feelings, family relationships, etc., play a major role. It would be an incomplete study to disregard any one part of personality function. Fatigue is the total personality reaction to work, mental, physical, or both. In order to aid a "fighting Navy," the acute type of fatigue should be stressed. The exhaustion syndrome described previously, with certain absolute qualifications, would be a close simile. Chronic fatigue, in the absence of any structural disease, is always due to personality difficulties. At the present time the obvious disposition is to return these individuals to civil life. Caution and conservatism should be the guide in evaluating any illness in which fatigue is the outstanding symptom.

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ALLERGIC REACTIONS TO PARENTERAL FLUID

Allergic reactions are usually attributed to substances of alimentary origin contained in the whole blood or serum to which the recipient is sensitive. They generally consist of localized urticaria with no systemic reaction. Less frequently, they consist of generalized urticarial manifestations with rise in temperature and occasionally with angioneurotic symptoms. Very rarely, a patient will develop an attack of true bronchial asthma during or after a transfusion of blood, plasma, or serum. The possibility of edema of the glottis must be considered, but from all reports on hand, it is probably extremely rare.—Strumia, M. M.; McGraw, J. J.; and Blake, A.: Reactions to parenteral fluid administration. Ann. Int. Med. **19**: 730, November 1943.

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SUSCEPTIBILITY OF ORGANISMS TO PENICILLIN

Susceptible strains	*Insusceptible strains*
Pneumococcus.	H. influenzae.
Streptococcus hemolyticus.	E. coli.
Staphylococcus albus.	B. typhosus.
Staphylococcus aureus.	B. dysenteriae.
Meningococcus.	B. proteus.
Streptococcus viridans.	B. paratyphosus A.
B. subtilis.	B. enteritidis.
Cl. welchii.	B. pyocyaneus.
V. septique.	B. fluorescens.
Cl. histolyticus.	B. prodigiosus.
B. sporogenes.	Friedlander's bc.
B. oedematiens.	Staphylococcus albus.
B. sordellii.	Monilia albicans.
Lactobacillus.	Monilia krusei.
Cryptococcus hominis.	Monilia candida.

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EFFORT SYNDROME AN ANXIETY STATE [1]

A PLEA FOR THE ELIMINATION OF MISNOMERS

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A fairly clear-cut type of psychoneurosis frequently encountered in service practice as well as in civilian life, is designated clinically and is recorded in the literature by a plethora of terms, most of them indefinite. Among these are irritable heart, soldier's heart, disordered action of the heart, neurocirculatory asthenia, effort syndrome and Da Costa's syndrome. It is obvious that confusion must arise from such a variety of appellations. Most of them are misleading in so far as they merely call attention to one or two physical symptoms and fail to indicate that the condition is psychogenic in nature.

During the past year, approximately 50 naval servicemen and officers have been referred to the neuropsychiatric department of this station with these various diagnostic labels. In each instance, physical examination indicated that organic pathologic changes were absent or unimportant, yet each man was to some extent disabled for duty by symptoms which he ascribed to physical causes. Psychiatric study showed that these physical disorders were due to functional derangement of 1 or more bodily systems, a derangement symptomatic of a psychic conflict often completely below the level of the patient's consciousness.

In many cases this conflict was found to be due to the insecurity and unrest caused by the sudden and complete readjustment necessitated by the transfer from civilian to service life, though in some instances the cause was found to depend on some purely personal or domestic problem or problems. Usually a study of the patient's personality revealed preexisting neurotic tendencies. Some men were described as tense, sensitive, worrisome or subject to doubts, indecisions or even mild phobias. At the time of referral to the neuropsychiatric department, each man showed a typical psychoneurosis or anxiety state.

This condition is listed under mental disorders, psychoneuroses, in the 1942 Standard Classified Nomenclature of Diseases and Statistical Manual issued by the American Psychiatric Association and the National Committee for Mental Hygiene. The following description of anxiety state was prepared for the Committee on Statistics and Forms of the New York State Department of Mental Hygiene (*1*):

[1] Presented before the Wartime Graduate Medical Meeting convened at Davisville, R. I., 16 December 1943.

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Cases which show more or less continuous diffuse anxiety and apprehensive expectation, with paroxysmal exacerbations associated with physiological signs of fear, palpitation, dyspnea, nausea, and diarrhea are to be classified here. Emotional tension is apt to be high and irritability and intense self-preoccupation may be prominent, particularly during episodes.

This condition is listed in the Manual of the Medical Department, United States Navy, as psychoneurosis, anxiety neurosis. Earlier writers, including Freud, also recognized the condition as fundamentally psychogenic.

Jelliffe and White (*2*) who quote Freud, give a comprehensive picture of the syndrome, using Freud's term, anxiety neurosis. They point out that the patients show emotional disturbances, notably general irritability and a sense of anxious expectation, and in addition, manifest widely divergent physical signs and symptoms. The latter may be referred to the cardiovascular system, appearing as palpitation, arrhythmia, tachycardia, and pseudo-angina; to the respiratory system, being manifested as dyspnea and other disturbances of breathing; to the gastro-intestinal system in the form of vomiting. diarrhea, anorexia, or increased appetite; or to the vasomotor or nervous systems, where they appear as various paresthesias, syncope and the like. Patients seen here exhibited many of these symptoms in various combinations. For this reason and because the cardiovascular signs were often absent or secondary, the terms irritable heart, soldier's heart, and disordered action of the heart are considered inappropriate. The following case illustrates how negligible the cardiac complaint may be.

CASE REPORTS

Case 1.—An officer, 44 years of age, married, was admitted to the medical ward because of vomiting, diarrhea and nervousness of 11 days' duration, the exact period of his active duty. Intensive physical and laboratory studies, including chest and gastro-intestinal tract x-rays, electrocardiographic studies, and blood and stool examinations yielded negative results, but the vomiting and diarrhea continued. While under treatment the patient also developed a hysterical amblyopia. His pulse rate was normal, and only once did he mention anything resembling a cardiac symptom. After 23 days he complained of precordial pain and palpitation, but these disturbances lasted only 12 hours.

A month after onset of symptoms the patient was transferred to the psychiatric ward. He was found to be intelligent and cooperative, and after a few psychotherapeutic sessions realized that he was physically well but had reacted neurotically to the difficulties of changing from civilian to military life, the separation from his family and an unconscious fear that he would not return to them. Mild sedation and continued psychotherapy resulted in a complete remission of symptoms and enabled him to leave the hospital in 8 days. He has appeared well adjusted since then.

It is interesting to note that the definitions given to neurocirculatory asthenia are identical with those applied to anxiety state.

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According to Paul White (*3*): "Neurocirculatory asthenia is a condition of ill health characterized by a group of symptoms consisting of dyspnea, palpitation, precordial pain, exhaustion, dizziness, nervousness and sometimes tremor, sweating, headache and syncope, aggravated by effort or excitement, or attending or following infection or physical or nervous strain, especially in 'hypersensitive' individuals, who in extreme cases may show the condition more or less constantly with little or no provocation." Wood (*4*) states that "There are 20 characteristic symptoms, the majority of which are present in any given case." To those noted by White he adds paresthesias, flushes, vascular throbbing, cramps, anorexia, dry mouth, vomiting or diarrhea, insomnia, and frequency of micturition, and points out that more than one-half the listed symptoms are present in any severe case.

It can readily be seen that the symptoms described by these authorities involve every system in the body. The syndrome is therefore poorly described by a term which indicates that the condition is limited to the nervous and cardiovascular systems. Exception is also taken to the use of the word asthenia, for genuine asthenia is found only in the severe cases. Patients with milder attacks are able to carry out their assigned tasks. The following case is representative.

Case 2.—A seaman, second class, 19 years of age, after 3 months in the Navy experienced mild chest pain while in bed. This was accompanied by palpitation, peripheral throbbing, mild dyspnea and some anxiety and depression. The symptoms disappeared in a few minutes, but recurred for short periods every few days until the patient became quite worried. He felt that running or other exercise aggravated his symptoms, and as his self-concern increased he developed anorexia and mild insomnia, reported at sickbay and was referred to psychiatry.

The patient's father and mother were reported to be suffering from heart disease. The patient himself has had frequent colds and headaches, has been considered high strung and still bites his fingernails.

Psychiatric examination showed him to be a rather sensitive, overly conscientious young man who had been overindulged as a child and was in a state of unrealized psychic conflict as a result of ambivalent desires. On the one hand he desired to carry out his orders and become a good sailor, while on the other he rebelled unconsciously at the regimentation and lack of the privileges and individual consideration that his ego demanded.

Because of his high intelligence and fundamentally good personality, he was cooperative with the psychiatrist, soon gained insight into his condition, and improved rapidly. Throughout his illness this patient was never asthenic, and his symptoms, although very distressing to him in the beginning, did not cause him to lose any time from his daily work.

Another case also shows that effort syndrome is a misnomer for this group of symptoms. This patient's disorder became apparent to him at night following a comparatively restful week, and it was only after his symptoms were well established that he felt effort occasionally exaggerated them.

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In 40 percent of the cases observed, the onset occurred while the man was at rest in bed or on guard duty. It is clear of course that the latter situation often entails excitement which White (*3*) has pointed out as an aggravating cause of effort syndrome. Modern psychiatry recognizes such excitement or tension as a form of anxiety arising from unconscious apprehensions and doubts. The tension may come to the fore either during the time when the patient is in the fear-producing situation or some hours later, and in various ways produce a sense of fatigue when he is off duty. Some fatigue, however, is psychogenic in origin and unduly heavy physical work or strain is not an important factor. In this series, the incidence of unusual effort preceding onset of symptoms was less than 30 per cent. The following case is typical.

Case 3.—An enlisted man, 22 years of age, like the patient just cited, had parents afflicted with "heart trouble." The patient himself was described as always having been somewhat sensitive and nervous. From the age of 7 years, he had suffered from a breathing disorder characterized by irregular short attacks of dyspnea with shallow, rapid respiration. Various physicians had examined him and had never been able to find any physical cause for the disorder. Six weeks after enlisting he reported for sick call saying that he thought he had heart disease because he had developed a pounding in his chest and neck and difficulty in getting his breath. Other troublesome symptoms were precordial pain, headache and dizziness, excessive sweating, tremors of the hands, anorexia, faintness and exhaustion, insomnia, anxiety, and depression.

For 3 weeks prior to the onset of these complaints, this man had been on watch and had done no drilling, marching or work requiring physical exertion. Complete clinical and laboratory studies were made and it was felt that all organic disease was ruled out. Psychotherapy and sedation were instituted, but the patient's condition rapidly became worse. His pulse varied from 88 to 144 per minute and he required constant bed care. It was recognized that he was too poorly integrated to give satisfactory service and medical survey for discharge was approved. Though there was no element of malingering, the patient's symptoms were due to his unconscious need for escape from a situation intolerable to him, and the promise of release brought about immediate relief of tension. He began to respond perceptibly to treatment, and in 1 month he was well enough to accept his discharge and return home unaccompanied.

One other term remains to be considered, that of Da Costa's syndrome. It is urged that this term also be allowed to lapse into disuse, as it is in no way descriptive or illuminating. The desire to honor our medical pioneers is laudable, but it is felt that this should not be at the expense of a clear nomenclature. A medical diagnostic term should be unmistakably linked with the etiology or pathology of the disease or disorder so as to aid the student and clinician, struggling to deal intelligently with an ever increasing wealth of medical facts and theories.

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CONCLUSIONS

The terms, irritable heart, soldier's heart, disordered action of the heart, neurocirculatory asthenia, effort syndrome and Da Costa's syndrome, are used to describe a well defined psychoneurosis classified as anxiety state in the Standard Nomenclature of Disease. It is suggested that psychoneurosis, anxiety state, replace all of the other terms. They are misleading or uninformative and do not call attention to the psychogenic basis of the disorder.

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CONTAGIOUSNESS OF TUBERCULOSIS

Contagiousness is not a definite fixed characteristic of tuberculosis. It varies with the epidemiologic conditions in the environment.

In a highly tuberculized environment tuberculosis is not a contagion.

In a not yet tuberculized or an already detuberculized environment, tuberculosis is contagious.

Our present environment is as a whole sufficiently tuberculized yet, so that most cases of pulmonary tuberculosis in our midst are not of direct contact origin.

On the other hand, there is already in our midst an increasing proportion of individuals, particularly young people, who develop chronic pulmonary tuberculosis of direct contact origin.

As some of these cases develop in connection with occupational exposure they come up for medico-legal consideration from the standpoint of compensation.

The only truly valid criterion for the latter is a lesion developing upon contact in a person known to have been tuberculin-negative shortly before.—Mayer, E., and Rappaport, I.: Contagiousness of tuberculosis: Its relationship to compensation claims. Dis. of Chest 9: 500–509, November–December 1943.

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THE SHOCK PROBLEM

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No one subject has received more attention recently than the problem of shock. In its study and management the clinical picture is the dominating factor influencing the procedure to follow. There is no one laboratory test nor any one method which is invariably applicable. In shock as in other fields of medicine the professional judgment and skill of the medical attendant must be relied upon ultimately.

This paper is submitted as a partial résumé of the current status of the shock problem. The bibliography has been covered quite completely and brings the list of shock and allied articles to date.

DEFINITION.

Shock has been variously defined, but the majority of writers stress anoxia as the basic cause of the condition. Too little emphasis, however, has been put on the resulting loss of glandular and cellular functions of the body. Considerable study has been made of the chemistry of tissues and also of the physiologic and chemical changes of the blood during the state of shock. It would seem necessary before much further progress can be made in the handling of this condition that more attention be given to the chemistry of the individual cell, its nutrition and protection from functional deterioration by means of secretory buffers.

PATHOLOGY OF SHOCK.

Irrespective of the cause of shock which terminates fatally in test animals, whether from burns, trauma, blast, or hemorrhage, there may be found a series of pathologic changes in the gastro-duodenal-jejunal portion of the alimentary canal. These changes may vary from acute hemorrhagic congestion to ulceration. Even perforation may occur. To a less degree there are similar changes which may be observed in the respiratory tract, the splanchnic nerve system, and the kidneys.

Clinical shock, as we see it, involves few pathologic changes, and the condition is more of a pathologico-physiologic nature with a predominance of cell atonia and exhaustion. The dysfunction applies to the skeletal muscles as well as to other tissues of the body. The great secretory organs such as the liver, pancreas, and adrenal cannot be expected to function normally under these conditions. Lacking their secretory products, cell metabolism is altered. The circulatory changes starting with diminished cardiac output include diminution of circu-

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lating blood volume, hemoconcentration, and consequent diminished cardiac output. If cerebral anemia, resulting from low blood pressure is allowed to persist too long, the higher centers cease to function. Shock becomes fixed.

The changes in blood chemistry involve primarily the pH of the blood, amino acid content and the carbon dioxide combining power. Glucose and the keto acids increase as the state of irreversible shock is reached. The normal arterial-venous oxygen ratio is upset and the liver, the main supply of which is venous blood from the intestinal canal, receives blood with 1 to 5 volumes percent in place of the expected 15. Long reports that in some animals before death it reaches the level of 0.5 volumes percent, creating an extreme anoxia of the liver tissue. The production of adenosine triphosphate in traumatized and shocked tissue is also under investigation as part of disturbed cell chemistry and as a possible toxic factor. It is recoverable in normal muscle and is believed to be the toxic factor in muscle extracts.

GENERAL TREATMENT

There is little to discuss in the general treatment of shock so far as the military services are concerned. The necessity of controlling hemorrhage is evident as well as that of protecting the patient from extremes of heat or cold. Blood pressure must be restored to as near a normal as quickly as possible if the cerebral centers are to retain normal function and the patient is to survive through the primary stages. Things which tend to increase the metabolic rate of the individual in shock must be avoided. Conversely those things which may be used to decrease the metabolic rate are the most useful adjuncts in shock therapy. There is incontrovertible evidence supporting the use of morphine hypodermically or intravenously as soon as possible after the time of injury. However the barbiturates in greatly reduced dosage are effective in holding a patient in a satisfactory mental condition, besides reducing his general metabolic rate. They may consequently retard the loss of fluid from the capillary bed.

The depth of shock is dependent upon a variety of factors. A young, active, highly trained and physically fit adult male will probably withstand more trauma than an older, flabby, poorly conditioned or exhausted individual. Physical fitness appropriately has a direct bearing on the resistance of the individual to shock and anoxia.

Cold packs, casts, and pressure dressings act alike in reducing the metabolic activity of the cells in the injured area. The casts and pressure dressings retard the local circulatory rate, causing a moderate circulatory stasis. Cold reduces the local temperature, thus slowing up the cell metabolism and curtailing the requirement for oxygen and food

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to maintain cell life. The use of the ice pack has permitted the salvaging of limbs that formerly would possibly have been amputated.

The use of plasma is admittedly one of the miracles of the age. It places within the circulatory system fluid of a kind which has been lost from the circulating blood, advantageously replacing the protein deficit in the blood. The use of concentrated plasma and crystalline albumin solutions intravenously have been on occasion equally successful.

CYCLE OF CELL METABOLISM

Further advances in the treatment of shock can only come from a better understanding and appreciation of the factors involved in the metabolism of the individual cell. First of these is oxygen. There is great variance of opinion regarding the value of oxygen administration in any other way than by inhalation. Green of Cleveland has produced "shock" by the use of low oxygen atmosphere alone if of sufficient duration.

Besides oxygen, water, and electrolytes a sufficient amount of proteins and carbohydrates are necessary to supply the cell with the energy and capacity for normal function. In this field more attention must be given to the part played by the cell enzymes and those adjuvant substances such as the adrenal hormones and the water-soluble vitamins, principally thiamine chloride and ascorbic acid. As has been recently demonstrated carbohydrate in the blood can be metabolized by the cell using ascorbic acid as the oxidizing agent instead of oxyhemoglobin. The activity of thiamine chloride as part of the molecule of carboxylase in the utilization of carbohydrates and lactates with the cortical sterones in the formation of liver or muscle glycogen and conversion back to blood sugar is equally important. It is moreover believed to be connected with the metabolism of the electrolytes.

The increase in blood potassium does not occur when the carbohydrate metabolism of protein is sufficient, either as the serum albumin, globulin or in the more simple form of polypeptides and amino acids. Shock from hemorrhage may result fatally in animals if the blood volume is restored with their blood and dextrose solutions. If succinates or fumarates are administered in the place of dextrose the animals will live.

The specific dynamic action of protein substances is well proved. Credit for this quality is given to the rapid utilization of six of the more common amino acids; glycine, alanine, glutenic acid, tyrosine, leucine, and phenylalanine.

Thorn, Quinby, and Clinton have proved the sustaining values of high protein meals.

It is believed that for cell metabolism to be kept at the highest efficiency in shock it is necessary to provide nutritive solutions con-

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taining amino acids, saline and ascorbic acid with other cell enzyme substances. Thus the most readily available fuel possible can be utilized. Shock is practically a condition of cell starvation. The use of nutritive solutions will conserve plasma.

It is recognized that 58 percent of the amino acids are metabolized as a carbohydrate. It is also recognized that about 20–25 percent of the nitrogen content of the amino acids will be excreted by the kidneys as urea within the next few hours after their administration. The demand for this excretion plus the volume of administered solution will avoid the suppression of urine due to hemoconcentration. It is well to remember that it is possible to give a patient too much sodium chloride in the form of normal saline solution.

So far as the hydrolysis of the polypeptides and the amino acids is concerned, it has another decided advantage. The pH of the blood in shock of long duration will get as low as 6.7, tending towards an acidosis. Moon reports that the average shock case will run a pH of 7.4 to 7.55. To counteract the acidosis of shock in the alkaline range the dipeptides' optimum lies between a pH of 8.0 and 8.4, while those of the amino acids go even higher, to 9.8 or 10.0. Even with moderate chemical buffer in the laboratory test tube there is a marked progression in the hydrolysis, so that the pH rapidly passes beyond the optimum points and there is a direct inhibition of enzyme action. This cycle, when taking place in the body, is undoubtedly one of nature's ways of providing part of the balancing of buffers to combat the acidosis of shock. It is repeated that amino acids increase in the blood stream as shock deepens and the pH falls.

The amino acids have already been used in a number of cases for the maintenance of the nitrogen balance in massive trauma, particularly those involving the liver, stomach, and the large intestine. There is accumulating evidence that amino acids used in postoperative patients when given intravenously were excellently handled by the individual. In a recent report by Elman, Weiner and Bradley they were used in 198 postoperative cases and 148 medical cases, all cases suffering from dehydration (hemoconcentration) and many in critical condition. There were some reactions in this series, but since their work, further improvements in the preparation and administration of amino acids have reduced the liability of this accident.

On the laboratory side, Elman and Lischer have recently reported in animals subjected to repeated hemorrhage that when a replacement fluid containing 5 percent hydrolyzed protein and 5 percent dextrose was used, the survival time of animals was markedly increased and the amount of blood which the animal could lose before death was increased by 25 percent. It is interesting in the report of this experiment that the hydrolyzed protein was more efficient than the solution of the crystalline amino acids themselves. "This condition

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may have been due either to known differences in amino acid composition or to the fact that the larger aggregates of amino acids (polypeptides) which comprised 30 percent of the protein hydrolysates are more beneficial than simple amino acids. The amount of nitrogen present was the same in the two solutions."

The fact that amino acids are increased in the blood in shock, both in dogs and in man, has been observed by both American and Russian investigators. Engel, Winton, and Long report that in shocked animals there is a close correlation between the elevation of blood amino acids and the depression of oxygen consumption by liver tissue. Treatment must be directed to the provision of those substances which will assist the liver and other tissue cells to carry on their normal functions. Shock treatment cannot be complete without it. The recent reports of the use of liver extract is support of the above premise. It has been observed that amino acid solutions administered through a duodenal tube, so that they pass through the liver on absorption, are better handled than when given intravenously. A more rapid healing of burns and ulcers can be obtained by their use as additional feeding of protein material.

KETOSTERONE METABOLISM

One of the most interesting findings in the condition of anoxia, postoperative trauma and burns is the fact that there is a definite increase in the urinary excretion of the 17-ketosteroids for the next few days immediately following injury. The group working with Dorfman in Cleveland and confirmed by Venning and Browne in Montreal has proved that there is an adrenal cortical-like substance which appears in the urine. Laboratory work has shown that this substance has the same cold-protective quality for adrenalectomized animals as cortical extract. Venning and Browne show however that this substance has only half of the glycogenic activity of the combination of 17-ketosteroids obtained from the adrenal cortex. Sterone excretion charts in humans as well as laboratory animals, make it apparent that the adrenal gland becomes active to produce the material necessary for the repair cycle of the body tissues, and that ketosterones from adrenal cortex are excreted in the urine after intravenous administration. From this evidence the supposition that these substances are required for the return of normal function in a damaged organism is quite tenable. The cells of the body must absorb them and after having served their purpose they are either metabolized or excreted. The only incomplete link in this chain would be to verify the work of Ungar at Oxford by examining the urine of his test animals to prove that this same cycle is taking place. From experience in other laboratory work and on humans one can but feel sure that increased 17-ketosterone excretion would be demonstrated during the develop-

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ment of the trauma-immune substance. The fact that ketosterones have not been recovered from human plasma in appreciable amounts makes for uncertainty as to the cycle of their metabolism and the ultimate form in which they become available to the body tissues.

THE ADRENAL CORTICAL EXTRACTS

Much research has been done in many excellently equipped laboratories to investigate the effect of adrenal cortical extract on laboratory animals. Some of it was very good and some of it has only served to confuse the subject. The evaluation of cortical extracts as now made has been well standardized, and it is possible to assay both the glycogenic and the electrolyte factor in the extracts on the market. That some damage can be done to the individual by the excessive dosage of certain extracts, has resulted in a reluctance in its use clinically. To the writer this seems unnecessary because cortical sterones composing the active ingredients of these extracts are fairly rapidly cleared from the body after their administration, when no excess of sodium exists, without pathologic findings. A normal individual is estimated to produce roughly 100 mg. of adrenal ketosteroids a day. Dosage not greatly in excess of that amount per day should be absolutely safe.

On the clinical side, it is reported that a not too highly refined cortical extract containing 4 to 6 parts of epinephrine per million was of inestimably greater potency in the treatment of clinical cases than the pure extract from which the epinephrine had been removed and in other tests in which the same amount of epinephrine had been restored to the purified extract. Whether this difference is due to the destruction of an amorphous quotient is unknown but is now subject to investigation.

There have been several reports that where cortical extract had been administered with plasma there seemed to be less plasma required to restore the patient. It is also recommended as shortening the period of anoxia due to circulatory stagnation in shock. Here also synthetic products of sustained epinephrine-like activity are reported of considerable value. It is extremely interesting to note that the adrenal cortical substance is one of the largest storage places of ascorbic acid in the body. The combination of ketosterones with this acid in a single gland gives credence to their synergistic action. The value of ascorbic acid in the healing of wounds has been repeatedly demonstrated. The value of cortical extract in the conditions of toxemia, particularly in burns, has been noted by several clinicians. The fact that cortical extract seems to reduce capillary permeability has also been reported by numerous observers. If the fluid loss, faulty metabolism of protein and carbohydrates, and the displacement of electrolytes are part of the picture of shock, then there is ample justification for the clinical use of a material which will influence these conditions.

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It is admittedly difficult to translate into humans the findings of laboratory animals in shock. It is sometimes difficult to understand the philosophy behind some of the experimental procedures which have so painstakingly been followed, and what might be expected to be proved which would help to clear rather than to confuse the clinical problem.

ADDITIONAL TREATMENT IN SHOCK

Supplementary to routine therapy in shock and the use of plasma, the addition of an animo acid solution, preferably a casein hydrolysate, is indicated as an immediately available cell food source. This is particularly enhanced by employing 2.4 percent disodium succinate. Moreover there is evidence that this solution is improved with the addition of a small amount (5 cc.) of adrenal cortical extract. A minimum supply of the 17-ketosteroids, and 200 mg. of ascorbic acid, as suggested by Ungar and others, will provide a complement which not only diminishes shock but also accelerates healing and can act either as an oxidizing or hydrolyzing agent. Thus the shocked individual will be provided with those substances which will carry him beyond that stage which it is possible to reach with plasma alone.

Traumatized cells require fluid. A prolongation of life in burned animals is reported by Rosenthal by the administration of saline by mouth or intraperitoneally up to 5 percent of body weight. This is a perfect example of the value of the passage through the liver of supportive fluids. Since the amino acid solutions are better used in dilution of 20 gm. per liter in dextrose or succinate solutions, at the same time, by giving food, fluid is equally provided. Furthermore a substance which will produce an increase in the pH in the course of its metabolism is administered, thereby tending to overcome the acidosis of shock. Protein hydrolysate solutions can be given by mouth concurrently with the administration of plasma, and the effective fluid intake is doubled. This also insures the passage of the supportive solutions directly through the liver. Nausea is markedly less when such solutions are administered by mouth rather than plain water.

SUMMARY

1. Shock is a state of general cellular atonia resulting from the effect of unbalanced cell metabolism. It is virtually a state of cell starvation.

2. The common pathology of all shock cases reaching autopsy irrespective of etiology suggests the need for investigation of specific means of prevention.

3. With our present knowledge we should not depend solely on plasma and plain saline or dextrose solutions for the therapy of shock

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aside from local dressings. Rectal and oral administration should be practiced with greater frequency, the latter by tube if necessary. Nausea will not be a factor.

4. Shock is an acidosis, and as blood pressure falls the amino acids appear in the blood and the keto acids are increased, an indication of the failure of protein metabolism.

5. Amino acid solutions administered as a protein hydrolysate provide not only fluid replacement but also cell food, an alkaline buffer, and aid in increasing kidney function, but should have enzymic assistance to be of maximum benefit. They can advantageously be administered either intravenously or by mouth.

6. Ascorbic acid not only limits the pathology of shock but accelerates healing and acts as an enzyme assisting cell metabolism.

7. Adrenal cortical activity influences carbohydrates and protein metabolism and reduces the amount of fluid replacement (plasma) needed. It is necessary in toxemia of burns with negative nitrogen balance.

8. Thiamine is believed to form a part of the carboxylase molecule, and without it complete carbohydrate metabolism is considered impossible. Glucose derivatives, succinates, fumarates, and lesser carbon compounds can be metabolized when the larger molecule cannot be split.

9. Tissue cell buffers, catalysts, and anticatalysts present in such minute amounts that their presence is hardly mensurable, determine the resistance and viability of the whole organism. Their ultimate recognition will go far to solve the problem of toxemia.

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LUMBAR HERNIA THROUGH THE TRIANGLE OF PETIT

REPORT OF A CASE[1]

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Sweet (*8*) in his discussion of rare hernias states that some forms are so unusual that surgeons of wide experience may never see a similar case. The occurrence of a lumbar hernia through the triangle of Petit is one of these instances. The first description of lumbar hernia was made by Paul Barbette in approximately 1672. Coley (*1*) reports two Petit triangle hernias, one was seen in consultation with Bull (1902) and the other was a personal case in 1920. Dowd (*2*) premises his paper with the statement that this condition is more of a scholastic than of a surgical topic.

Although there are several weak points in the lumbar region through which a hernia may present itself, two sites are more frequently involved. They are the superior and inferior triangles.

The superior lumbar triangle of Grynfelt (Lesshaft) is bounded above by the twelfth rib and the lower border of the serratus posterior inferior muscle, internally by the anterior border of the quadratus lumborum muscle, externally by the posterior border of the obliquus externus abdominis muscle, and below by the obliquus internus abdominis muscle. The upper lumbar triangle varies in shape—triangular, deltoid or rhomboid depending upon the size of the last rib and the extent of the attachment of the serratus posterior inferior muscle.

The inferior lumbar triangle of Petit is bounded below by the crest of the ilium, by the latissimus dorsi muscle behind and the obliquus externus abdominis muscle in front.

In 1738 a case of strangulated hernia through the triangle that bears his name was described by Petit (*11*). Although Petit had not described this triangular space more fully than Dobee, Garangeot, Ravaton, and Balin, nevertheless the triangle of Petit, Petit's triangle and trigonum lumbale (Petiti) have become the accepted designations.

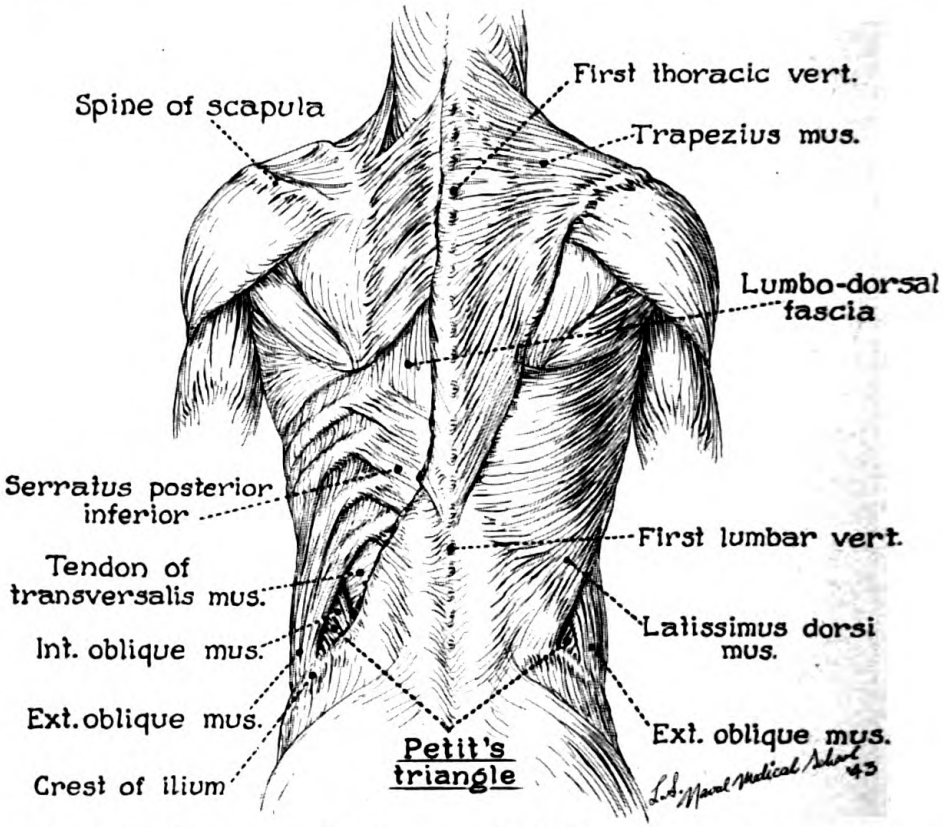
In 1866 Grynfelt (*5*) described the superior lumbar triangle in the following manner:

> The aponeurotic fibres of the transversalis in dividing form a passage for the lower intercostal artery, just as the spermatic cord enters the two pillars of the external ring. There is at this site a natural point of lessened resistance.

[1] From the First Surgical Service of Mary Immaculate Hospital, Jamaica, N. Y.

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If the lower border of the internal oblique inclines more anteriorly than normally, the last intercostal artery perforates the aponeurosis of the transversalis above the border. In other words, if the point of resistance of this artery is in the lumbocosto-abdominal triangle all the conditions favoring a hernia are realized.



1. Anatomical relationship of triangle of Petit viewed posteriorly. (After fig. 408, p. 429, Gray's *Anatomy of the Human Body*. 24th edition. Edited by W. H. Lewis. Lea & Febiger, Philadelphia, 1942.)

Four years later Lesshaft without mentioning Grynfelt described this same triangle.

Hernias occur through the space of Grynfelt more frequently than through the space of Petit; both however are rare. Boracz in 1907 after an exhaustive study collected and reported in Lagenbeck's Archives a total number of 68 cases of lumbar hernia.

As mentioned previously the latissimus dorsi muscle has an intimate relationship with the triangle of Petit. Its fibers may be attached farther backward or the obliquus externus abdominis fibers may be attached farther forward on the iliac crest, which accounts for variations in the size of the triangle. It may appear as a slit between these muscles. Its base may measure ½ to 1 cm., or if a large triangle the base may measure 4 to 6 cm. Its height ranges between 1 and 7 cm. Since there are no openings for blood vessels or nerves it would seem improbable that hernia would rise through Petit's triangle. Expressed another way the triangle of Petit is not

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likely to be the site of a hernia. That this is a fact is substantiated by the low incidence of this type of hernia when one reviews the literature.

Lesshaft examined 108 adult cadavers and found the triangle of Petit present in 84 cases, or 77 percent. Goodman and Speese (*4*) examined 76 adult cadavers, finding an incidence of 63.3 percent. The incidence of hernia through Petit's triangle is shown in table 1.

TABLE 1.—*Lumbar hernia through triangle of Petit*

	Location				Sex	
	Left	Right	Bilateral	Not given	Male	Female
Goodman	19	10	2		22	7
Watson	15	6	1	8		

The left side predominates and the hernia occurs three times as frequently in males as in females. Thus, the very low incidence of hernia through Petit's triangle is not easily explained.

The etiology of hernia connotes such terms as congenital (constitutional or distention type); acquired (spontaneous); acquired traumatic. Differences of opinion are given by equally eminent authorities on the origin of hernia. Hitzrot (*7*) believes "the etiology of hernia is still a matter of discussion and that there is always a congenital background, i. e., a preexisting deficiency in the areas in which hernia occur, and that the hernia primarily is the result of this congenital deficiency, and that where the deficiency exists unusual effort or strain will cause the area to give away." By acquired (spontaneous) is meant indirect traumatism, e g., habitual or sudden strain, lifting, coughing, twisting, et cetera. This is often referred to as the indirect type. Acquired traumatic includes direct trauma (injury), incisional and postoperative causes. That such variance of opinion persists is noted in the following statements. "The only hernia through that area which I have seen was one which was regarded as a congenital hernia in a child and I have not seen the traumatic variety described by Coley"—(Hitzrot). Rishmiller (*13*) writes that this type of hernia is almost always congenital, may be acquired though rarely traumatic, yet in his case trauma was the immediate exciting cause. He mentions also that in his case it was due to weakness of the obliquus internus abdominis muscle. He further states that little is known as to the cause of this hernia, as only four cases have been operated upon and reported to the year 1917.

The subjective symptoms are few. The patient may complain of pain in the back, pain on exertion, lifting and straining, tenderness on pressure over the prominence or there may be a feeling of fatigue on exertion. Objectively, there is a round or oval mass in the lumbar

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region which usually can be easily reduced and the hernial aperture can be outlined. X-ray studies (opaque enema) may support the clinical diagnosis, as in Turner's (*16*) case.

CASE REPORT

A colored man, 23 years of age, was admitted to the hospital complaining of pain in his left lumbar region. He stated that 3 weeks previously while repairing an automobile he twisted himself and experienced a sharp pain in his back. He noticed a slight swelling in his left loin above the iliac crest, which increased in size on coughing. During the past few days the pain had become worse and at times so severe that he applied local heat to his back without relief. He had a similar pain over this same area 7 years ago and was told that he had a cold in his kidney. At this time he was treated for nephritis at a hospital during a period of 3 months.

The physical examination revealed a well developed, young, adult male who was not acutely ill. His temperature, pulse, respiration, and physical findings were within normal limits, except the local condition over the iliac crest. Here a small round bulge presented itself on coughing and was attended with pain.

The laboratory findings were inconsequential. With the diagnosis of a lumbar hernia the patient was advised operation.

Under general anesthesia an incision was made for a distance of 10 cm. over the iliac crest. The superficial fascia was next incised. Proceeding with combined sharp and blunt dissection, Petit's triangle was exposed, and the floor was separated in the direction of the fibers of the internus abdominis and the transversalis muscles. Great care was used not to injure the parietal portion of the peritoneum. There was no direct bulge of the peritoneum. Repair was carried out by obliterating the triangle, utilizing the fibers of the latissimus dorsi and the obliquus externus abdominis muscles. This was accomplished with interrupted chromic catgut sutures. The fascia was brought together and imbricated, using interrupted chromic catgut sutures. Finally the skin edges were closed with black silk sutures.

The patient's postoperative course and convalescence were uneventful. The wound healed by first intention. On the eleventh postoperative day the patient was allowed up and out of bed. At this time there was no impulse on coughing and no evidence of a recurrence or weakness of the posterior abdominal wall. Six months later this patient was found to have a very good result. There was no evidence of herniation, and he was able to resume his usual occupation.

DISCUSSION

The question of whether or not a sac is present is debatable. Sweet (*8*) writes that usually there is a sac but in a number of cases none can be demonstrated. Coley on the other hand states that in most cases there is no sac, and that a sac composed of peritoneum is often lacking both at operation and at postmortem. If a sac is present the contents may be protusion of peritoneal fat, intestines, appendix (Higham) (*6*), or kidney.

Clinically the diagnosis of lumbar hernia should not be difficult. It, however, must be differentiated from a simple abscess, a Pott's abscess, or a lipoma. The usual classical signs of swelling, inflammation, pain,

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and temperature are absent in hernia. The clinical history associated with general physical findings, laboratory aids, and roentgen studies will rule out Pott's disease. The physical characteristics alone of a lipoma on the other hand, will distinguish lumbar hernia from this type of tumor.

The usual methods of closure may be listed as follows:

Closure by—

1. Owen	Catgut.
2. Kuster	Skin muscle bone flap.
3. Bull	Overlapping muscle and fascia with kangaroo tendon.
4. Dowd	Fascia lata flap and aponeurosis—maximus and medius.
5. Rishmiller	Splitting aponeurosis—latissimus dorsi flap.
6. Coley	Overlapping suprapubic muscle layers.
7. Stubenbord	Overlapping muscle and obliquus internus fascia (imbrication).

Although different anatomical structures are used in the repair of this type of hernia, fundamentally the principles are the same as those involved in herniorrhaphy in more classic situation.

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PILONIDAL CYSTS

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The frequency of pilonidal cysts among men training for service in the armed forces has been repeatedly recorded in the literature. Most of these patients are in advanced courses at air, radio, officers training, and other specialized schools, and a period of hospitalization seriously interferes with the training period. In cases of pilonidal cysts treated by orthodox methods the average period of morbidity is 2.7 months. The present study is approached from the standpoint of reducing the undue period of hospitalization and the percentage of recurrences.

Embryology.—The origin of pilonidal cysts is based on two theories regarding their development from ectodermal or entodermal vestigial remnants. Mallory (*1*) and others believe that pilonidal cysts develop from remnants of the neural canal that have become separated from other neural elements in this part of the body, or are present in the form of a cord-like structure extending from the region of the cord to the skin in the sacrococcygeal region. In confirmation of this theory Ripley and Thompson (*2*) cite two cases in which meningitis developed from an infected pilonidal cyst, while Moise (*3*) reports a case in which spinal fluid gushed during the excision of a pilonidal cyst.

The more popular theory is that these cysts are the result of improper coalescence of the two halves of the body. Fox (*4*) studied a series of sections from different embryos and concluded that vestiges of the neural elements in the coccygeal region give rise to tumors, while those of ectodermal origin give rise to pilonidal cysts. With the exception of the two mentioned, in none of the cases reported in the literature was any anatomical connection between these cysts and the neural elements found in this region.

Pathologic anatomy.—A study of the pathologic anatomy in these cases gives the best indications as to the choice of treatment. Rogers and Hall (*5*) made serial section studies of 44 specimens. They found that the majority of pilonidal cysts are simple tubular structures with 1 or 2 closely associated sinus openings. Infection of these cysts follows the line of least resistance and accessory sinus openings are formed. The persistent granulating inflammatory sinus becomes epithelized from both ends. Injection of these sinuses with dyes

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stains lymphatics as well as cysts, requiring a wider excision than is necessary. Recurrences are frequently due to retention of infected tissue or to faulty healing because of infected dead space. The specimens studied in our laboratory confirm these findings. All block specimens showed wide excision with considerable normal tissue in the block. Specimen from recurrences revealed infected scar tissue and cavities formed in the dead spaces from scar tissue.

Surgery.—The accepted methods of treatment of pilonidal cysts fall into 1 or 2 procedures; excision with scalpel or cautery and packing the wound, or excision with primary closure. Rogers and Dwight (*6*) report 140 cases treated by cautery excision and packing, with good results. Their patients were treated in an out-patient clinic and were not hospitalized. Forty-five cysts were excised with primary closure by Dunphy (*7*). In his series there was a short healing period and few recurrences. Ferguson and Mecray, Jr., (*8*) report 37 cases treated with excision and primary closure with 92 percent cures.

Cases.—Twenty-three patients with pilonidal cysts were treated by operation over a period of 6 months. Two patients had been operated upon elsewhere and were considered to have recurrences. They were treated by excision and packing the wound. One patient who had been operated upon at another hospital had a wide painful scar which broke down and bled on the slightest trauma. In another instance the cyst was complicated by the presence of anal fistula so that primary closure was deemed inadvisable. This leaves 20 pilonidal cysts that were treated by excision and primary closure. Two of these failed to heal and the wound opened when the sutures were removed. In 1 case a hematoma was found postoperatively and the wound healed by secondary intention. In 17 cases the wounds all healed by primary intention without complications.

The average healing time was 16 days, the shortest being 9 days and the longest 30 days. Healing time was considered as the number of days following operation before the tissues were firm, normal in color and the patient had no symptoms upon sitting or standing. It was necessary to judge these cases on this basis because many of the patients were hospitalized for more than one condition and others could not be returned immediately to duty for various reasons.

In one patient there was a recurrence 2 months after his discharge from the hospital and reoperation was necessary. Follow-up is almost impossible at a naval hospital because these men return to duty in various parts of the country. No immediate recurrence has been seen, due probably to the fact that these patients are kept in the hospital 5 weeks before they are returned to duty. It seems reasonable to assume that there will be few, if any, recurrences when healing is prompt and without complications.

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Method of treatment.—Careful preoperative attention and postoperative care are as important as the operation itself. Preoperatively all cases of pilonidal cysts were considered infected and placed into one of three grades. Grade 1 included those cases presenting one or more sinuses in the midline with or without a discharge, and with no redness or discoloration at the sinus exit. Usually there was a history of previous infection or abscess formation. The cysts were probed and if the discharge was small in amount and clear, they were operated upon immediately. If the discharge was purulent, heat was applied for several days before they were excised.

Cysts having a purulent discharge with redness of the sinus exit, tenderness, and fluctuation, were graded 2 and treated conservatively by probing and the application of heat for 7 to 10 days and then excised.

In grade 3 were placed those cases in which incision and drainage of the abscess were necessary to control the infection. These patients were not operated upon until all evidence of infection had disappeared. Fifteen cases were grade 1, three grade 2, and one grade 3. This experience suggests that infection must be controlled before excision and primary closure may be done successfully.

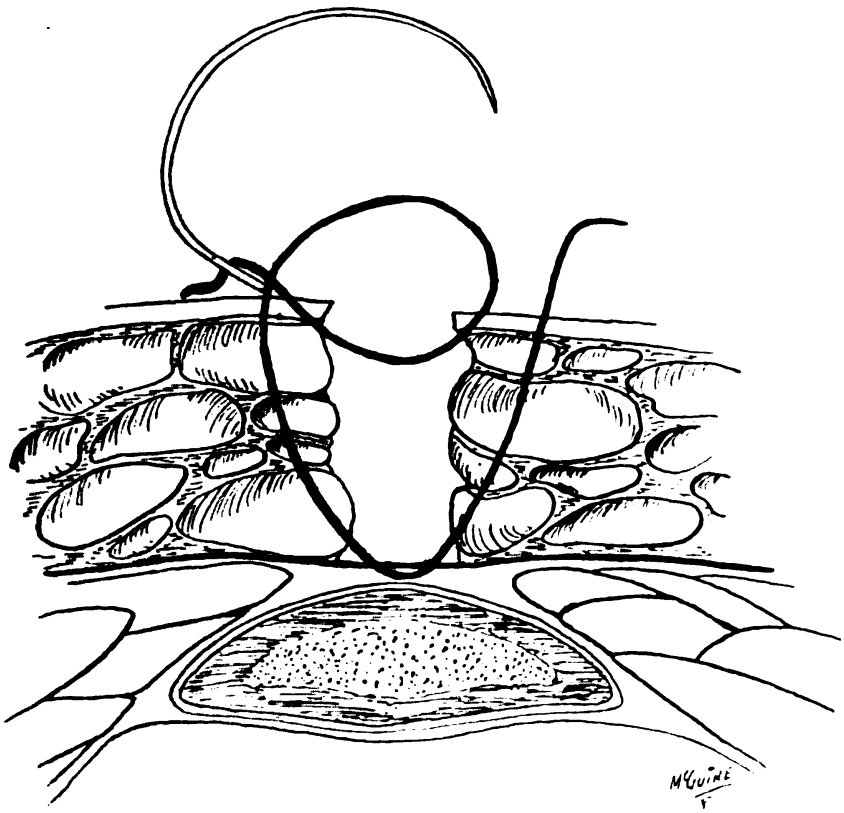
Spinal anesthesia was used in all instances. The patients were placed in the Kraske position and the buttocks held apart by means of adhesive straps attached to the edges of the operating table. Each sinus opening was explored with a probe to determine its direction. Invariably the lowest sinus pointed upward. The incision was planned so as to remove a minimum of normal tissue, and to be as far away from the depths of the gluteal sulcus as possible, because healing is poor in this area. Incision was done with the scalpel, removing the tissue in one block down to the sacrococcygeal fascia. All bleeding points were clamped and ligated with fine cotton, cutting the ends very short so as to reduce the amount of foreign material buried in the wound. We have not used catgut in these wounds since two of them developed serum and drained postoperatively. The use of sulfanilamide was also found to increase the production of serum in these wounds.

If necessary the edges were undermined and the attachment of the gluteal fascia to the sacrum incised, as closure without tension is of prime importance to proper healing. The edges were approximated with fine cotton sutures and the skin closed with alloy steel wire sutures. In the more recent cases closure was effected by two methods. In one method the tissues were approximated by a figure-8 suture of alloy steel wire passed through all layers and returned through the skin edges. In the other, the deep tissues were approximated with fine cotton sutures and the skin closed with a subcuticular running

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suture of alloy steel wire. It is my belief that two factors are essential for healing; perfect hemostasis and obliteration of all dead spaces and pockets.

After operation a small, thin gauze dressing is applied so that bowel movement will not cause soiling. A small roll of gauze is tied to the line of incision with the free, loose ends of the sutures, and the buttocks are strapped tightly together to create a pressure dressing in order to prevent undue tension during the first 3 or 4 days while the patient is confined to bed. After the first bowel movement, usually



1. The edges are approximated by using a figure-8 alloy steel wire suture, the first loop of which includes all layers, the second loop approximating only the skin margins.

on the third day, the dressing is changed if necessary. It is better not to change the dressing until the sutures are removed. The patient is allowed out of bed on the tenth day and instructed to be careful in sitting down not to slouch back on the end of his spine but to sit well up on his hip bones. The sutures are usually removed on this day. After 2 weeks the patient is allowed a full range of activity but is carefully watched for another week.

Complications.—In two instances the wounds did not heal and opened when the sutures were removed. Sulfanilamide was placed

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in the wounds and they were sutured with catgut. In one case a hematoma developed and healing was delayed. In another the edges of the wound became soft and gray and a culture showed the presence of a fungus infection; this responded to treatment.

CONCLUSIONS

A series of 23 patients with pilonidal cysts is presented; 20 of these were treated by excision of the cysts and primary closure of the incision. In 3 cases final healing did not occur.

In the 20 patients in which primary closure was done the average healing time was 16 days. There was 1 recurrence.

Microscopic examination of specimens removed showed that in many cases a wider excision had been made than was necessary. In those cases where the sinus had been injected with a dye, the dye was found outside the pathologic tissue, and in a few the dye did not reach all portions of the cyst.

Primary closure should not be attempted until the infection has been reduced to a minimum.

Perfect hemostasis and obliteration of all pockets and dead spaces are necessary for healing by primary intention.

Keeping the buttocks strapped together eliminates tension and prevents separation of the wound in the early healing period.

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X-RAY TREATMENT OF PILONIDAL CYSTS

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Experience has shown that patients operated upon for pilonidal cyst are incapacitated probably 30, and possibly up to 90 days. Moreover surgery is often followed by recurrence, necessitating a second operation.

Four clinical types of pilonidal cyst may be differentiated:

Type 1.—Type 1 is characterized by a small sinus opening (the original congenital hiatus) in the internatal fold, with very slight purulent or seropurulent drainage. There is no history of acute infection. Patients with this type of cyst usually have very little discomfort. Some will do well with scrupulous hygiene and a good dusting powder, or may require several superficial x-ray treatments. It is questionable whether surgery should be resorted to in this type of case, inasmuch as the condition may not become worse throughout the patient's military service.

Type 2.—Patients with type-2 cysts give a rather short clinical history. There has been either an acute abscess formation with drainage through the original hiatus, or a rupture dorsally through the skin. There is a choice of several methods of treatment including radical surgery, that is, the eradication of the several sinus tracts together with much of the subcutaneous and adipose structure. I do not feel that this should be done. A second method of treatment is wide incision and drainage of the infected area. This is usually satisfactory, but requires scrupulous hygienic after-care until the entire area has healed. It probably is the method of choice in this type of pilonidal sinus infection when it is followed by routine x-ray therapy. There are always some infections which will not heal after incision and drainage, and will require further surgery.

Type 3.—Patients with type-3 cysts usually give a history of having had a draining, granulating sinus for 1 or more years. The cyst has ruptured dorsally, the skin having been broken through at some time when the infection originally established itself. In this group, it will be found that radical surgery of the sinus tract, rather than the more conservative approach of incision and drainage, will give better clinical results. In the majority of cases this will be the only type for which the patient should be hospitalized and obliged to remain on the sick list until the lesion is well healed. However, x-ray therapy will often cure cases in this group.

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Type 4.—The fourth type consists of pilonidal cysts which have recurred following previous operations.

I have used x-ray therapy in all four types. The patients required no absence from work or duty while under treatment. The most successful results were obtained in those cases classified in groups 1 and 2. Many patients of the group 3 have been cured with x-ray therapy supplemented by probing of the sinus channels to remove loose hairs which interfere with the proper drainage of the infected tissue.

It is felt that where facilities for x-ray therapy are available, this treatment should be given routinely in all types of pilonidal cysts for a period of about 30 days. During this time it will be found that some will heal completely and in others there will be considerable subsidence of the inflammatory process, leaving a cleaner and a more definitely circumscribed area should future operation become necessary.

One patient in group 4 had had two operations, one involving removal of the coccyx. In spite of these radical procedures, there was a recurrence of the pilonidal cyst. Following two courses of x-ray therapy there was complete regression of the infection and cessation of drainage.

Gratifying results were achieved by x-ray therapy in types 1 and 2 while many type-3 cysts healed satisfactorily. The suggested course consists of 80 roentgen units, given every third to fourth day for eight treatments, using 140 KVP with a 3 mm. aluminum filter. This dosage may be repeated within 1 month if it is felt that the improvement warrants a further attempt at complete cure.

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KALA-AZAR CURED WITH PROPAMIDINE

In previous papers records have been published of the successful treatment of three Indian cases of kala-azar, two with stilbamidine (4:4′-diamidino stilbene) and a third with pentamidine (4:4′-diamidino diphenoxy pentane). The treatment of a fourth case of Indian kala-azar with the allied compound propamidine (4:4′-diamidino diphenoxy propane) is recorded.

The patient, a Hindoo seaman, aged about 30, was treated daily by intramuscular injection of propamidine in doses of 100 mg. This dosage was roughly 2 mg. of propamidine per kilo. of body weight. The immediate result of treatment was a sharp rise of temperature to as much as 104° F. some hours after each injection, for the first four days of the course. Thereafter the rise steadily became less marked, and the temperature did not exceed 101° F. but gradually settled to normal, where it remained two days after the completion of the ninth and last injection. The patient's general condition improved and his sense of well-being increased after the first few days of treatment.—Adams, A. R. D.: A case of Indian kala-azar treated with propamidine (4 : 4′-diamidino diphenoxy propane. Ann. Trop. Med. 37: 96–97, September 7, 1943.

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SERUM TREATMENT IN SELECTED CASES OF MENINGOCOCCUS MENINGITIS

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In 1942 the San Diego Naval Hospital had such gratifying success in the treatment of meningococcic meningitis with sulfonamides alone that the use of serum was felt to be superfluous, if indeed not actually contraindicated (*1*). Most of the recent literature corroborates this view. However, during the first 4 months of 1943, in a series of 86 cases in the San Diego area, there were 2 deaths, a mortality rate of 2.3 percent. In addition, 3 other cases almost certainly would have died if serum had not been used in addition to sulfonamide therapy.

Since the initiation of sulfonamide therapy for meningococcic meningitis in 1938 and 1939, very few reports have appeared advocating the use of serum. In spite of the fact that Branham (*21*) and Amies (*8*) found sulfonamide and serum were more effective than either alone, many articles suggest that serum therapy is unnecessary (*12*) (*13*). It is the purpose of this paper to point out the efficiency of serum in a small percentage of cases which failed to respond to sulfonamides alone.

TREATMENT

The sulfonamide treatment used in this series has been the same as that used with such good results in the previous series reported by us (*1*). Sodium sulfapyridine, 4 or 6 gm., is given intravenously initially, followed by 2 gm. every 4 hours. After the patient becomes rational or able to retain the drug, it is continued orally in doses of 1 gm. every 4 hours to a total dose of 30 to 40 gm. Three thousand cubic centimeters of intravenous fluids are given daily (1,000 cc. normal saline and 2,000 cc. 5-percent dextrose). During the period of intravenous medication, patients with depression of the respiratory center are given oxygen, respiratory stimulants, and spinal puncture or hypertonic dextrose to reduce intracranial pressure. Those showing any evidence of vasomotor hypotonia or shock are given plasma. One patient with severe shock was given desoxycorticosterone.

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FATAL CASES

Case 15 was a 21-year-old Marine Corps private. He had been ill 36 hours prior to admission. On arrival he was comatose, his neck was rigid, and he had positive Kernig and Brudzinski signs. There were many petechial hemorrhages in the skin. The spinal fluid pressure was 700 mm. of water. The spinal fluid cell count was 9,920 per cu. mm., with 90 percent polymorphonuclear cells. Smears were negative for microorganisms, but culture of the spinal fluid revealed gram-negative diplococci which agglutinated in Type II meningococcus antiserum. The blood culture was negative.

He was given sulfonamide therapy, intravenous fluids, cortin, and spinal decompression. His condition rapidly deteriorated; the blood pressure fell, the heart failed, and marked pulmonary edema developed. The spinal fluid cell count did not drop with treatment, though the sulfapyridine blood level reached 18.7 percent. He died 27 hours after admission.

At the autopsy, the meninges covering the parietal and frontal lobes were found thickened, injected, and covered with exudate. There was no free fluid at the base of the brain, or in the exposed portion of the spinal canal. The lower lobes of the lungs were wet and congested. The adrenal glands were normal.

Case 43, a 21-year-old Marine Corps private, was admitted semicomatose and very restless. His neck was rigid and Kernig and Brudzinski signs were markedly positive. There were no skin lesions. The spinal fluid was cloudy and contained 17,500 cells per cu. mm. and 98 percent polymorphonuclear cells. Smears showed gram-negative diplococci. Spinal fluid culture revealed a gram-negative organism which agglutinated in Type I meningococcus antiserum. The blood culture was negative.

In spite of the coma and restlessness, his condition was considered good and he was started on sulfonamide therapy. During the first 12 hours he became quieter and his general condition improved. Following this, he again showed signs of marked intracranial pressure, with restlessness, slow pulse, and Cheyne-Stokes respiration. Spinal puncture was repeated and 20 cc. of fluid removed slowly, without apparent benefit. The spinal fluid cell count had risen to 26,750, of these 95 percent polymorphonuclear cells, in spite of a spinal fluid sulfonamide level of 6 mg. percent. It was evident that the neurologic signs were due to cerebral edema or to intense meningeal congestion, and courses of hypertonic dextrose were started. No treatment was effective, the patient's condition deteriorated and he died 39 hours after admission, 14 hours following the last spinal puncture.

At the autopsy the brain was found to be enlarged, very edematous, and the convolutions flattened. The ventricles were compressed. The meninges were slightly injected, but free of exudate. The cause of death was herniation of the medulla and vermis through the foramen magnum.

REPORT OF SERUM TREATED CASES

Case 42 was a 17-year-old marine who was admitted to the hospital with a diagnosis of purpura hemorrhagica. However on admission there was marked nuchal rigidity and positive Kernig and Brudzinski signs. He became comatose soon afterward. The skin was covered with large hemorrhagic areas, especially marked on the extremities. The spinal fluid contained 770 cells per cu. mm. (70 percent polymorphonuclears) and gram-negative diplococci. The blood culture was positive for gram-negative diplococci which agglutinated in Type II alpha meningococcus antiserum.

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Sulfonamide therapy was instituted but his condition became progressively worse. Forty-eight hours after admission the spinal fluid cell count had risen to 16,885, polymorphonuclear cells 95 percent. His condition was considered hopeless in spite of a blood sulfonamide level of 19 mg. percent and a spinal fluid level of 7 mg. percent. It was felt that anything which might avert his death should be tried. The Type II alpha meningococcus recovered from his blood was agglutinated with the four antimeningococcic sera on hand. A four times concentrated polyvalent serum was the only one showing Type II alpha antibody (see chart), and this was given intravenously in four doses of 30–20–30–20 cc. respectively at 12-hour intervals. The response was startling. In 12 hours he was rational and in 24 hours it was evident that he would recover. Convalescence was complicated by gangrene of the purpuric areas. These are now filling in and epithelizing well.

Case 46, a 20-year-old seaman was admitted, irrational, and showing signs of increased psychomotor activity. The nuchal rigidity was marked and Kernig and Brudzinski signs were positive. There were numerous petechiae in the skin over the trunk and extremities. Spinal puncture revealed a spinal fluid pressure of 490 mm. of water. The Queckenstedt test was normal. The fluid was cloudy and contained 4,150 white cells per cu. mm., 98 percent polymorphonuclear cells, and gram-negative diplococci. Cultures showed a gram-negative diplococcus which agglutinated with Type I meningococcus antiserum. Blood culture was negative.

Intravenous sulfonamide therapy was instituted. His response was poor. He lapsed into deepening coma. The respiration became Cheyne-Stokes in type, and the pulse became slow. Twenty-four hours after hospitalization, the spinal fluid cell count had risen to 12,600. The blood sulfonamide level was 16 mg. percent. His failing condition was attributed to increased intracranial pressure. A repeated spinal puncture gave inaccurate pressure readings because of a leaky manometer; however the Queckenstedt test was normal. Twenty cc. of spinal fluid was removed, and two doses of 50 cc. of 25-percent dextrose solution were given intravenously, both apparently without effect. Twenty-four hours after admission he was moribund and his condition seemed hopeless.

Polyvalent serum which agglutinated with the Type I organism recovered from his spinal fluid was given intravenously in doses of 30–20–30–20 cc. at 8-hour intervals. The response was striking. Within 24 hours he was calm and rational. Recovery was uneventful.

Case 49 was an 18-year-old apprentice seaman admitted with a diagnosis of meningococcic meningitis. On admission the temperature was 105.4° F. The neck was rigid, the Kernig and Brudzinski signs were positive, and the patient was incoherent. There were many small purpuric spots in the skin over the trunk and extremities. Spinal fluid contained 5,900 white cells (80 percent polymorphonuclears) and gram-negative diplococci; the spinal fluid culture showed a gram-negative diplococcus which agglutinated with Type I meningococcus antiserum.

During the first 48 hours his response to sulfapyridine was excellent but after this period he became disoriented and stuporous. The blood pressure and pulse remained normal. The spinal fluid pressure was 100 mm. of water and Queckenstedt test was normal. The spinal fluid cell count, however, had risen to 28,500. The culture was negative. His condition became extremely poor and it was obvious that sulfonamide therapy was not adequate, in spite of a blood sulfonamide level of 14 mg. percent. Concentrated polyvalent antiserum which agglutinated his Type I meningococcus was given in three doses of 30–60–30 cc. at 12-hour intervals. The therapeutic response was excellent. Within 24 hours he was rational and markedly improved. Convalescence was uneventful.

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DISCUSSION

Following the second death (the 93rd case seen within the past year) it became evident that in spite of the usual excellent results obtained with sulfonamides, a small percentage of cases would fail to respond to this treatment. In our experience this has been between 3 and 5 percent.

The exact mechanism operative in these therapeutic failures is not completely understood, but it may be due to either or both of two factors; first, toxic material from the meningococci which persists in the blood stream after the sulfonamides exert the bactericidal effect; second, a meningococcus which does not respond or becomes resistant to drug therapy. In either case serum is indicated.

After the second death it was decided to use serum therapy in addition to sulfonamide in all cases that failed to show definite clinical improvement within 24 to 36 hours. This gives a period for careful study of the patient as well as adequate time to grow and type the organism (*14*). However in some rare instances, patients moribund on admission or those who rapidly fail, should have the benefit of serum without waiting for the sulfonamide to take effect.

SPECIFICITY OF ANTISERA

Many meningococcus antisera in the past have failed because of a lack of specific antibody for some of the types of meningococci. It is essential that the sera used contain the antibody specific for the type of meningococcus causing the disease. Our first case illustrates this point. Three of four antisera on hand failed to agglutinate this Type II alpha organism, even though labeled polyvalent. Newer polyvalent antisera contain Type II alpha antibody.

As the first case (42) in which this regimen of serum therapy was started was caused by Type II alpha meningococcus and it was not known whether the available polyvalent antisera contained Type II alpha antibody, this organism was agglutinated with these antisera and the serum agglutinating the organism most rapidly and in greatest dilution was used. Cases 44 and 49 were caused by Type I meningococcus and were treated the same way.

The following is a table of the four available antisera which agglutinated with Types I and II alpha meningococcus in dilutions from 1:50 to 1:1600. Readings were made after shaking 4 minutes. Agglutination occurring after the four-minute period is considered less specific and less clear cut and the results are therefore not recorded.

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TABLE 1.—*Agglutination reactions*

Brand of serum	Type of organism	Serum dilutions					
		1:50	1:100	1:200	1:400	1:800	1:1600
A[1]	I	++++	++++	++++	+++	++	+
	II alpha	++++	++	±	±	−	−
B[2]	I	+++	+++	++	±	−	−
	II alpha	−	−	−	−	−	−
C[2]	I	+++	+++	+	±	±	−
	II alpha	−	−	−	−	−	−
D[3]	I	−	−	−	−	−	−
	II alpha	−	−	−	−	−	−

[1] Serum A was 4-times concentrated, purified meningococcus antiserum.
[2] Sera B and C were unconcentrated meningococcus antisera.
[3] Serum D was a so-called meningococcus antiserum.
Note that only A contained Type II alpha antibody.

Meningococcic antisera are now being manufactured in the following forms:

1. Monovalent type-specific rabbit serum.
2. Polyvalent refined and concentrated horse serum.
3. Polyvalent unconcentrated horse serum.

They are listed in the order of their therapeutic effectiveness (*20*).

The monovalent type-specific antiserum will require accurate typing of the meningococcus in each case.

SUMMARY

In a series of 86 cases, there were 2 deaths from meningococcus meningitis, and 3 cases which almost certainly would have died without specific serum therapy in addition to sulfapyridine.

These cases are presented to stress the effectiveness of the specific serum therapy in that small percentage of meningococcic meningitis cases which fail to recover on sulfonamides alone.

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DIGITALIS IN WOUND TREATMENT

Digitalis glucosides, when applied in form of compresses or as an ointment, exert an intensive local reaction resulting from a direct action of the digitalis on the cells of the capillary wall, the exact nature of which is not known. Probably the permeability of the vessel wall is diminished. The edema in the vicinity of the vessels recedes. Ease of capillary flow and cell metabolism in the wound is increased and facilitates regeneration after elimination of the damaged tissue. The best illustrations are old, torpid wounds which, under digitalis, are transformed within a few days into healthy granulating wounds. Almost simultaneously epithelization starts at the border of the defect. Although this restorative process is not so apparent in fresh wounds, it enables one to obtain primary healing of surgical wounds in debilitated persons.—Schlaepfer, K.: Digitalis in the treatment of wounds. J. Internat. Coll. Surgeons. 6: 443–447, September–October 1943.

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THE TREATMENT OF SEVERE TONSILLITIS IN A NAVAL DISPENSARY

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In the management of illness in military cantonments, the cardinal principle is to reduce the number of hours lost from active duty to a minimum. With this in view, an attempt was made to evaluate the effect of sulfa therapy on acute pharyngotonsillitis.

Observations made in a naval dispensary this past winter revealed that acute tonsillitis and acute pharyngitis were the greatest sources of loss of time due to illness. Out of 961 admissions to the sick list during 2 winter months, 250 cases were admitted with these diagnoses. This constitutes 26 percent of the total admissions during that period. In addition, there has been a considerable number of cases admitted with diagnosis of catarrhal fever, in whom after a period of observation, the diagnosis was changed to either acute tonsillitis or acute pharyngitis. Inasmuch as the average length of stay in the sickbay in each case amounted to several days, the loss of time from duty is considerable, and frequently disrupts the training program.

Another factor to be considered is that the crowded conditions aboard ships and on shore stations enhance the spread of such infections with the impending danger of widespread epidemics such as have been recently reported in a military camp (*1*).

The value of sulfa drug therapy in certain of the more serious debilitating diseases has received much attention, but its value in some of the more common conditions has been overlooked. A review of the literature of the past 2 years reveals very few studies on the treatment of throat infections. It is the conclusion of a number of authors that the sulfonamides are of value in proved cases of hemolytic streptococci tonsillitis and pharyngitis (*2*) (*3*) (*4*) (*5*). Others while impressed with the results of sulfonamides in other streptococcic infections have noted little favorable effect in these cases (*6*) (*7*) (*8*).

Rhoads and Afremow (*9*) reported on the treatment of 67 nurses who had contracted tonsillitis while on duty. Thirty-one received sulfanilamide and 36 did not. It was concluded that the drug did not reduce the severity of the symptoms, shorten the period of incapacity,

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modify the incidence of complications, or affect the duration of the carrier state. Toxic reactions occurred in one-half of the cases treated. However, it must be noted that in all these cases the drug was withheld until cultures were returned, an average of 2.8 days. During this period most of the damage is done and complications are developing.

Our study was carried out in a naval dispensary attached to a regiment in recruit training, where close and continued observation was possible. The patients were examined and classified as either acute tonsillitis or acute pharyngitis. However, the cases included in this study are only those in which the clinical diagnosis could easily be made, due to the presence of patchy or membranous exudate either on the tonsils or on islands of lymphoid tissue in the pharynx. The presence of this exudate was the criterion for the diagnosis, because with a large number of cases admitted, cultures were impractical.

Previous to beginning this investigation, orders for these patients included bed rest, fluids in abundance, and antipyretics such as aspirin or phenacetin compound tablets. In observing the progress of these patients it was noted that frequently the sulfa drugs were resorted to in an attempt to shorten the illness because of unusual duration or threatening complications. Therefore it became of interest to study the difference in hours of disability, both as regarded hours of temperature and hours in the sickbay, in patients treated with and without chemotherapy. The cases accordingly were grouped as follows:

1. A group in which the chemotherapy was withheld throughout the illness.

2. A group in which the sulfonamides were given after a period of observation, bed rest, fluids in abundance, aspirin and phenacetin compound tablets.

3. A group in which the sulfonamides were administered early in the illness.

Table 1 indicates the results of treatment in terms of time.

TABLE 1.—*Results of treatment*

Group	Type of sulfa treatment	Number of cases	Average duration of temperature (hours)	Average duration of stay in sickbay (hours)
1	None	15	77.6	109
2	Late	25	60	95
3	Early	150	28.8	55.7

Group 1 includes 15 consecutive cases admitted to the sickbay. The figures themselves are significant by comparison with the other groups. It was also of considerable interest to note that in addition to the increased length of illness, the severity of symptoms was proportionally more marked. In our opinion, the response in the second group, after the administration of sulfa drugs, was so uniformly

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good that the treatment of choice in these severe throat infections appeared definite. The third group was then begun in which the sulfa drugs were administered immediately or shortly after admission to the sickbay.

The criteria of cure or usefulness of chemotherapy in the treatment of these cases have been placed on a mathematic basis, that is hours of disability. It might be added, however, that in the vast majority of cases, sore throat, the patient's one outstanding complaint, was alleviated so quickly as to leave no doubt of the effectiveness of the drugs.

COMMENT

In reviewing the results of this investigation we realize that some important factors have been omitted, namely the causative organisms and complications. Because the number of cases is relatively large and included clinically the most severe types of throat infections, it was felt that all types of organisms would be included and cultures, therefore, were not thought essential. The additional hours of illness resulting from complications were included in the final tabulation of all groups.

It will be noted that the total number in the control group is one-third the number of the treated group. The explanation is that as the study progressed the favorable effects of the sulfa drugs were readily seen and it was felt that to withhold therapy would unnecessarily prolong the patient's illness. To prove this point the cases in group 1 were the last to be included in the study and were kept to a minimum.

Early in the study relatively large doses of sulfonamides were used to build up a high blood concentration quickly. By experimentally reducing these amounts the lowest effective dosage was found to consist of an initial dose of 30 grains of sulfathiazole or sulfanilamide, followed by sulfathiazole 7.7 grains (sulfanilamide grains 10) every 4 hours. The early morning dose (2 a. m.) was omitted. Occasionally larger doses were thought desirable if complications threatened. No mention is made of sulfadiazine as it was not available.

Careful observation was kept for toxic effects; however they were infrequent, the most common being cyanosis following the use of sulfanilamide. The duration of illness was so shortened that prolonged administration was unnecessary and serious toxic effects were not observed.

CONCLUSION

In a series of 150 cases of severe acute tonsillitis and pharyngitis treated early with sulfonamides, the average duration of time lost was one-half that of a series of 40 cases which received sulfa treatment late or not at all.

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SPEED OF ADMINISTRATION OF PARENTERAL FLUID

Concerning the speed of intravenous administration of fluids, it is safe to state from practical experience and from the experimental work that if the concentration is isotonic, a rate up to 20 cc. per minute is perfectly safe and well tolerated. However, this rate may be altered either up or down, depending upon the need of more rapid blood volume replacement or the patient's cardiac condition. Thus, in patients in very severe shock, it is necessary to administer intravenous fluids, particularly plasma or blood at a much faster rate than that just mentioned. As much as 500 cc. of material can be administered in a period of 10 minutes. Beyond this quantity, it is advisable to reduce the rate of administration.

On the other hand, in a patient in whom cardiac weakness is suspected, rates of fluid administration not exceeding 10 cc. per minute should be advised. This is particularly true for the administration of whole blood because of its higher viscosity. Under these conditions, a rate of 5 cc. per minute appears desirable. Within these limits it is reasonable to assume that the danger of reaction from speed of administration can be ignored.—Strumia, M. M.; McGraw, J. J.; and Blake, A.: Reactions to parenteral fluid administration. Ann. Int. Med. 19: 724–725, November 1943.

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CHLORACNE (CABLE RASH)

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The first observations of a dermatosis caused by contact with chlornaphthalenes and chlordiphenyls were reported in 1935. Since that time numerous articles have been written as to the causative factors and control of this condition.

Chloracne is very common in the shipyards of this country where fireproof and waterproof cable is used. It will continue to exist due to the great acceleration of the shipbuilding program, the increased use of fireproof and waterproof cable, the fact that cables are now more highly impregnated than in the past, and the failure of many yards to use proper protective measures.

Investigation has proved that this dermatosis is caused by contact with cable that is coated or treated with either chlorinated naphthalene, chlorinated diphenyl, or chlorinated diphenyl oxide. The resulting compound is occasionally known as "halowax" or "chlorowax". In the wiring of ships this type of cable is used in the intercommunication and fire control systems. The wires must be "stripped" before installing and it is in this manner that personal contact is made.

The diagnosis of the dermatosis is not difficult, as there is a definite history of exposure to the cable wax of from at least 1 to 2 months. There is a striking resemblance to acne vulgaris, from which it must be differentiated. Areas not commonly involved in acne vulgaris, or only slightly so, are frequently the sites of marked involvement in cable rash. These areas are behind the ears, the nape of the neck, buttocks, thighs, knees, abdomen and lower back. Comedones, while present, are not a predominant feature. Acneform lesions are usually pale and straw-colored. The skin may be dry in contrast with the greasy skin of acne vulgaris, and the lesions are very persistent in comparison to the transitory lesions of that disease.

The lesions consist of comedones, papules, pustules, and cysts, which have no opening onto the surface of the skin. Inflammatory papules, and infection of both the papules and cysts are predominant in the more marked cases. The cystic lesions vary from 1 to 2 mm. up to 1 cm. or more in diameter.

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The type of skin of the individual plays a large part in general susceptibility. A young individual, who is still in the acne age, is more prone to develop cable rash than an older man. A person with a seborrheic type of skin is particularly susceptible. The condition is more prevalent in hot than in cold weather. It is also more common in workers who have the "hand-to-face" habit.

Medically, this condition is very difficult to treat once it has started, and many months of constant care and observation are necessary before it can be brought under control. Preventive measures, therefore, are of the utmost importance.

1. Older employees should be used whenever possible in installing cable.

2. Exhaust ventilation should be used to catch the fumes and small flakes of chlorinated wax.

3. Protective ointments should be applied to the hands, face, neck, and other exposed parts. Commercial creams are available. These ointments should be applied before starting work in the morning, washed off during the lunch hour, and then reapplied before continuing work.

4. Separate lockers should be supplied for street clothes and working clothes. Street clothes should never be worn at work. It is not unusual to see lesions in the family of the worker if work clothes are worn home.

5. Daily shower baths should be compulsory after work. Workmen engaged in handling cable should be allowed sufficient time for washing before lunch and for taking a shower before changing to street clothes upon completion of the day's work.

6. A special cleansing soap, consisting of the following agents should be provided the workers:

	Gm. or cc.
White corn meal	50.0
Butyl stearate	22.5
Sulfonated castor oil (75 percent oil)	22.5
Oleic acid	5.0

Mix the oils together and then add the corn meal.

This mixture is to be rubbed onto the skin and then removed with water. The procedure should be repeated. The mixture may be used as a cleansing agent by workers before the cable rash develops, as well as by those suffering from the disease.

7. Work clothes should be changed daily. If possible, these clothes should be laundered at the Yard and not taken home. A light colored, highly starched, coverall should be worn over the working clothes. These should be laundered at least once a week, but preferably if practicable each day.

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In addition to the above recommendations, the following advice is given to those who are exposed to the cable, whether or not they have developed the rash:

1. Avoid as far as possible all contact of skin with the material. Do not bring hands to face or neck while working with the cable.

2. Do not use wiping rags for the nose and face. Use clean handkerchiefs or cleansing tissues.

The treatment of the dermatosis is along lines similar to those used in acne vulgaris. Locally a non-oily preparation is recommended. The following formula fulfills this requirement very well, and can be used as a curative and a preventive measure:

	Gm. or cc.
Potassium sulfide (50 percent solution filtered)	60. 0
Zinc oxide	30. 0
Sulfur ppt	30. 0
Glycerin C. P	5. 0
Fluid rose (soluble)	1. 0

This lotion is applied nightly before retiring and after a thorough cleansing of the skin. It is washed off in the morning. It should be borne in mind that sulfur itself may cause a dermatitis.

It is of the utmost importance that mechanical expression of comedones and drainage of pustules and cysts should be done. As the condition is recurrent in nature, it is deemed advisable not to resort to the use of x-ray treatments because of the danger of overexposure.

It is of prime importance, in this condition, that the preventive measures be stressed. Medical measures, while they may improve or cure, do not prevent recurrences. In severely involved cases it is best to remove the worker from any further exposure, as contact gives marked recurrences with deep-seated infection.

At the Philadelphia Navy Yard over 200 cases of cable rash are under the observation and care of the industrial health officer. In this series we have had 2 workers who had to be removed from this type of work. The progress of all other cases is satisfactory under the above regime.

SUMMARY

1. The incidence of cable rash is increasing.

2. Cable rash is caused by contact with chlorinated waxes, i. e., chlorinated naphthalene, diphenyl and diphenyl oxide.

3. Diagnosis is made on history of exposure and characteristic acneform lesions.

4. Preventive measures are of the utmost importance in controlling this condition.

5. These preventive measures should be supplemented by medical supervision and treatment.

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MUSCULAR TONUS AND SHOCK

Maintenance of a normal circulation (i. e., a normal minute-volume output by the heart) depends not merely upon an effectively functioning myocardium but also upon the delivery through the veins to the right side of the heart of a quantity of blood sufficient to fill the cavities. There had long been difficulty in explaining satisfactorily the mechanical factors which bring about the return flow of an adequate volume of blood through the veins. The valves in the veins serve an important function in determining the direction of flow and preventing any reflux back into the tissues. Manifestly they do not contribute any positive force to the circulation. There is also a small positive pressure in the venous end of the capillaries and venules which in conjunction with an intrathoracic pressure which is slightly below the atmospheric pressure, propels blood toward the heart. This vis-a-tergo, however, is relatively slight and seemed scarcely an adequate explanation, particularly in conditions in which the blood flow is accelerated.

It has been shown that an important contributing force is provided by the contractions of the skeletal muscles.

Even when the body is as completely at rest as possible, the muscles are continuously in a state of partial contraction or "tonus." This tonus is maintained by stimuli coming through the motor nerves from the motor nuclei of the spinal cord and bulb. During rest only a few of the muscle bundles are contracting at a given moment, but the successive contraction and relaxation of the muscle bundles exert a similar booster action that differs only quantitatively from that accompanying voluntary contraction.

The degree of muscle tonus and its accompanying "booster" action depends upon the "tone" of the spinal motor centers. When the tonic influence of the motor centers fails, the skeletal musculature becomes flaccid. Because of this flaccidity, the intramuscular pressure falls; the capillary pumps cease to operate; and the venous return to the heart diminishes until it becomes insufficient to allow the heart to maintain the arterial blood stream and pressure. So the first, or circulatory stage of shock develops.

As the rate of blood flow falls, the oxygen requirement of the tissues is not met, and tissue asphyxia results. Seepage of the plasma from the capillaries then sets in, with progressive decrease in blood volume, further slowing of the circulation, and finally an abrupt fall in arterial blood pressure.

Saline solution will restore the circulation temporarily, but plasma is far more efficient. Leekage of plasma from the vessels is due more to tissue asphyxia than to loss of plasma protein.—Editorial. Ann. Int. Med. 19: 817–819, November 1943.

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SKIN DISEASES ABOARD A DESTROYER

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By far the greatest number of visits to the sickbay aboard a destroyer is for ailments of a dermatologic nature. In their order of prevalence the five most important conditions are:

1. Epidermophytosis and trichophytosis.
2. Furuncles and carbuncles.
3. Miliaria rubra (heat rash).
4. Pediculosis pubis.
5. Impetigo contagiosa.

Table 1 is based on the number of visits to the sickbay from July 1942 to April 1943. There was a total of 4,628 visits or an average of 16 daily. Of this number 1,238 or 26.75 percent were dermatologic cases. In some instances one patient had 2 or more different lesions simultaneously.

The basis for the occurrence, frequency, and aggravation of many of these diseases is primarily due to three factors:

1. The lack of proper bathing facilities.
2. The crowded condition of the crew's quarters.
3. The high atmospheric temperature of the tropics. Destroyers are designed for a limited complement, and war often necessitates increases far above the planned accommodations of the ship. Crowded conditions consequently cannot be avoided.

That this status is responsible for many of the skin lesions is illustrated by the low incidence of all skin diseases with the exception of athlete's foot, among commissioned and chief petty officer personnel, whose living space and bathing facilities are more ample.

TABLE 1.—*Incidence of dermatologic lesions*

Disease	Number of visits	Percent of visits	Disease	Number of visits	Percent of visits
Athlete's foot	374	8.03	Herpes zoster	12	0.28
Ringworm	312	6.73	Tinea versicolor	8	.17
Furuncle	222	4.77	German measles	7	.15
Heat rash	119	2.57	Urticaria	6	.13
Pediculosis pubis	72	1.34	Pityriasis rosea	5	.11
Impetigo	47	1.02	Drug dermatitis	3	.07
Scabies	21	.45	Lupus erythematosus	2	.05
Herpes simplex	18	.39			

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Many of the men do not wear socks, allowing for constant reinfection with fungus, as well as for contact leather dermatitis from shoes. Clothing is not changed as often as is desirable. Despite daily scrubbing of the deck in the crew's head, washing and airing of the duckboards of showers, and the installation of hypochlorite foot baths, athlete's foot continues to be the largest dermatologic offender.

Ringworm has been commonly first observed about the buttocks and groin, suggesting that head seats were involved in its spread. After thorough scrubbing, daily airing in the sun, and alteration of seats, an appreciable drop in incidence was noted. However the incidence was still high, indicating that those already affected and not treated were instrumental in its spread.

The occurrence of furuncles and carbuncles assumed major proportions following the scraping of the ship's paint. The paint chippings became adherent to the skin and in most instances were scraped off with none too clean fingernails. Minor infected lesions developed, resulting ultimately in multiple furuncles and carbuncles.

Passage of the ship from a temperate to a tropical climate not only increased the incidence of skin disease, but markedly aggravated those already existing.

A striking observation worthy of note and reported by others is that most of the skin diseases encountered are of an infantile type.

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DIAGNOSIS OF MALARIA BY LIGHT FILTER

Contrast filters are necessary in photography of colored or stained objects. A diagnosis of malaria after a short search for the parasite is not the rule. When the young malarial forms, the "signet-ring" merozoites, are present, the closest study is required. The thick drop method of crowding the red cells into the oil immersion field does not often disclose the intracellular location of the parasite.

A suitable light filter will produce the maximum contrast between the parasite and the red cells without of course affecting the stain for routine study. Blood stains are essentially a combination of methylene blue and eosin. It was found that of the various Wratten light filters the E light red filter has a spectral transmission range parallel to that of eosin. Moreover, this filter transmits a higher percentage of incident light in the red part of the spectrum than does eosin. Consequently the red cells actually appear lighter. The absorption of all blue (and green) light by the E filter renders the blue-stained elements distinctly darker. This contrasts sharply with the pale shadow or "ghost" rendition of the red cells. In a specified examination period 3 to 4 times as many parasites can be located as with normal lighting.—Cares, R.: Rapid diagnosis of malaria by the use of a Wratten light filter. J. Lab. & Clin. Med. 28: 1750–1751, November 1943.

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CARE OF THE TRACHEOTOMIZED PATIENT

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The care of the patient after tracheotomy depends for the most part on nurses and corpsmen in attendance. As in other operations their instruction and guidance, however, requires special consideration from the surgeon.

Because of the type of operation a trained attendant must be present constantly. The patient should never be left alone. If for any reason it is necessary to withdraw from the room a capable substitute should be provided. Attention to details is of such importance that improper handling or management of a single procedure may cost the patient his life.

The principal care of the tracheotomized patient from the standpoint of nursing resolves itself to two considerations: First, the mechanical operation of the tube and, second, the proper control of room humidity and temperature.

Not the least important duty in handling the tube mechanism is the technic of securing it in proper position. This is accomplished by the use of wash tape, approximately one-half inch in width. This can be purchased at any retail department store. A piece 10 to 12 inches in length is fastened to each side of the tube. It is advantageous to have them of such length that the knot can be placed on either side of the neck rather than at the back. A hard square knot must always be made.

A square piece of gauze (4 by 4 inches) which has been moistened with a 1:10,000 solution of bichloride of mercury is cut in such a manner as to permit straddling of the tracheotomy tube. Loose threads should be removed in order to prevent their aspiration. It is advisable to change the gauze frequently.

The inner tube must be removed and cleaned as often as necessary in order to keep a free airway. The cleaning can be accomplished with an ordinary pipe cleaner or with a cotton-tipped copper applicator previously moistened with a 1:10,000 solution of bichloride of mercury. The following is a practical method of cleaning the tube. Both ends of a piece of silkworm gut are passed through the cannula, leaving a loop extending beyond the lumen. Through this loop is placed a piece of gauze of suitable size and then by pulling the ends of the gut the gauze is forced through the tube. An advantage of

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this method is that it requires no special equipment. Both inner and outer tubes should be thoroughly cleaned prior to sterilizing.

The outer tube is changed at least once every 24 hours. While in the trachea it is kept clean by frequent suctioning, using a soft rubber catheter attached to a suction mechanism capable of creating sufficient vacuum to remove viscid secretion. The catheter must be inserted about ½ cm. to 1 cm. beyond the end of the tracheotomy tube, since it is around the end of the tube that secretions accumulate.

Whenever the outer tube is changed a Trousseau dilator or a curved hemostat should be available in the event difficulty is encountered while inserting it. Proper exposure of the trachea and good illumination facilitate replacing the tube.

A good suction apparatus is essential for removing viscid secretion. Some apparatus will draw up water but are inefficient with fluids of greater viscosity.

Various solutions dropped into the tracheotomy tube prior to suctioning will aid in the liquefication of the secretion and hence facilitate its removal. Sterile physiologic saline solution or a sterile solution of either neosynephrin (0.25 percent) or ephedrine (0.5 percent) may be used. Artificial spinal fluid has proved more satisfactory than any other preparation. Two or three drops are put in the tracheotomy tube immediately preceding the introduction of the soft rubber catheter.

Artificial spinal fluid is similar to normal cerebrospinal fluid in mineral content and pH.

It may be necessary to remove viscid plugs with bronchoscopic forceps through the bronchoscope. Since these plugs may form very rapidly it is advisable to have the necessary bronchoscopic equipment available, connected and ready for insertion.

It is important that the patient be kept in a steam tent, steam room, or in one with controlled humidity and temperature. If either of the first two mentioned methods are used arrangements should be made for adequate ventilation in order to prevent too high a temperature. Such facilities materially aid in preventing the formation of viscid secretions.

The objection to a steam room is that everything in it becomes damp and the atmosphere is oppressive. Unless special mechanism has been installed it is difficult to control the temperature. If a steam tent or canopy is placed over the bed, adequate ventilation must be provided. Even with such an arrangement the temperature usually is elevated beyond the level of comfort. To avoid increased heat and humidity Davison [1] has recommended the use of a mechanical humidifier.

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[1] Davison, F. W.: Some observations on control of temperature and humidity in oxygen tents. Ann. Otol., Rhin. & Laryng. 49: 1083–1090. December 1940.

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However such an apparatus is available in only a few hospitals and one must usually resort to other measures.

The steam vaporizer should be used only intermittently, the room kept well ventilated, and a temperature below 70° F. maintained. Davison has pointed out that if the temperature and humidity are both raised, perspiration is induced and water loss results.

By whatever means are necessary, an adequate fluid intake should be maintained; water by mouth, saline solution subcutaneously, and dextrose solution intravenously are given.

Ammonium chloride or potassium iodide in adequate doses by mouth, added to the food if necessary, will be most helpful.

In the presence of infection or when indicated, sulfonamides are appropriate. No drying effect from these drugs has been noted and even if this were the case it would be preferable to combat any drying effect than sacrifice the advantages of the sulfonamides.

Oxygen therapy is very beneficial at times but the administration of oxygen ought not be prolonged since it tends to produce a more viscid secretion. There is no advantage in using carbon dioxide since the respirations are generally accelerated.

Transfusion of whole blood or injection of plasma is very helpful at times.

Opiates definitely increase the viscosity of the secretions and are strictly interdicted.

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EFFECTIVENESS OF CHEMOTHERAPY AGAINST INFLUENZA VIRUS

Several sulfonamides, acridines and antibiotics have been tested in this laboratory to determine their effectiveness in conferring protection against influenza virus. It has been reported by other workers that certain sulfonamides used in conjunction with azochloramide, pyridium or neoarsphenamine against bacteria gave better results than when either compound alone was used.

The PR-8 strain of influenza A virus was used throughout our experiments.

SULFONAMIDES

Drug	*Dosage administered daily (contained in 0.2 cc.)*
1. Sulfanilamide	1 mg.
2. Sulfathiazole	1 mg.
3. Sulfapyridine	1 mg.
4. Sulfadiazine	1 mg.
5. Benzenesulfamido-m-ethylphenol	4 mg.
6. 2-amino-5-azobenzenesulfonamido-pyridine	4 mg.

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Drug	Dosage administered daily (contained in 0.2 cc.)
SULFONAMIDES—continued	
7. Carbonyldisulfanilamide	3 mg.
8. Thionyldisulfanilamide	4 mg.
9. Azobenzenesulfonamidotrypaflavine hydrochloride	1 mg.
10. 2-ethoxy-6, 9-diaminoazobenzenesulfonamido-acridine	1 mg.
11. Caproyl-p-benzenesulfonamide	4 mg.
12. Caproaldehydesulfonamide	4 mg.
13. O-hydroxybenzyl-p-aminobenzenesulfonamide	4 mg
14. Sulfuramine	1 mg.
15. 2-ethoxy-6, 9-diaminobenzeneamidothiazol-acridine	4 mg.
ACRIDINES	
1. Trypaflavine	2 mg.
2. Proflavinehydrochloride	2 mg.
3. Rivanol	2 mg.
ANTIBIOTICS	
1. Penicillin	5 mg. (650 Oxford units)
2. Tyrothricin	5 mg.
3. Tyrocidin	5 mg.
4. Gramicidin	5 mg.
5. Subtilin	5 mg.
OTHER COMPOUNDS	
1. Azochloramid	0.02 mg.
2. Pyridium	.02 mg.
3. Neoarsphenamine	.001 mg.

None of the compounds tested under the conditions of these experiments, alone or in combination, was effective in preventing influenzal infection in mice.—The Personnel of Naval Laboratory Research Unit No. 1: Attempts to protect against influenza virus with various sulfonamides, acridines and antibiotics. Science 98: 348–349, October 15, 1943.

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CLINICAL NOTES

PRECORDIAL LEAD OF ELECTROCARDIOGRAM TAKEN DURING ONSET OF AN ANGINAL PAIN

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and
DEAN C. DENMAN
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The following is the report of a case of probable coronary occlusion, which, having made apparently normal progress toward recovery for 5 weeks, developed a sudden, mild pain in the precordium for 10 seconds during the taking of the precordial lead of an electrocardiogram.

The patient, a 42-year-old surgeon, developed severe substernal and epigastric pain while performing an operation. The duration of the pain was about 30 seconds. A few minutes later he resumed operating, completing without incidence. Following the attack, he noted a dull aching pain in the left arm, which gradually became quite severe and subsided after 48 hours. No pallor, perspiration, dyspnea, or palpitation were noted during or following the attack. He continued at his duties for the next 2 days without distress except for a heavy feeling beneath the sternum. He then asked for an examination, as he suspected a cardiac origin for the pain.

The past history was negative for symptoms of a similar nature. He had had an electrocardiographic examination 4 months previously, as part of a general physical examination, and this had been reported as normal. He had smallpox in 1924, an appendectomy in 1928, and a tonsillectomy in 1926.

The family history revealed that his mother, age 72 years, is living although she has heart disease. His father is 70 years of age and in good health.

The physical examination was irrelevant and in no way helpful toward a diagnosis.

His blood Kahn was negative.

An electrocardiogram revealed the following: Rate 90; sinus rhythm; P–R interval 0.16 second, QRS interval 0.12 second. The QRS complexes showed marked slurring and bundle branch block. R_4 was very small (1 mm.) and there was a deep downward deflection following the R (28 mm.). S–T junction in leads 1 and 2 was depressed and there was a high take-off in lead 4. T_1 upright, T_2 diphasic, T_3 inverted, T_4 high take-off and diphasic (fig. 1).

The patient was treated by absolute bed rest, sedation and light diet. He was very comfortable except for occasional complaints of extrasystoles and fleeting precordial pain. Temperature remained normal, pulse varied between 80 and 90. Other electrocardiograms were taken at weekly intervals and the patient seemed to be making fair progress. One of the tracings made is shown (fig. 2) revealing

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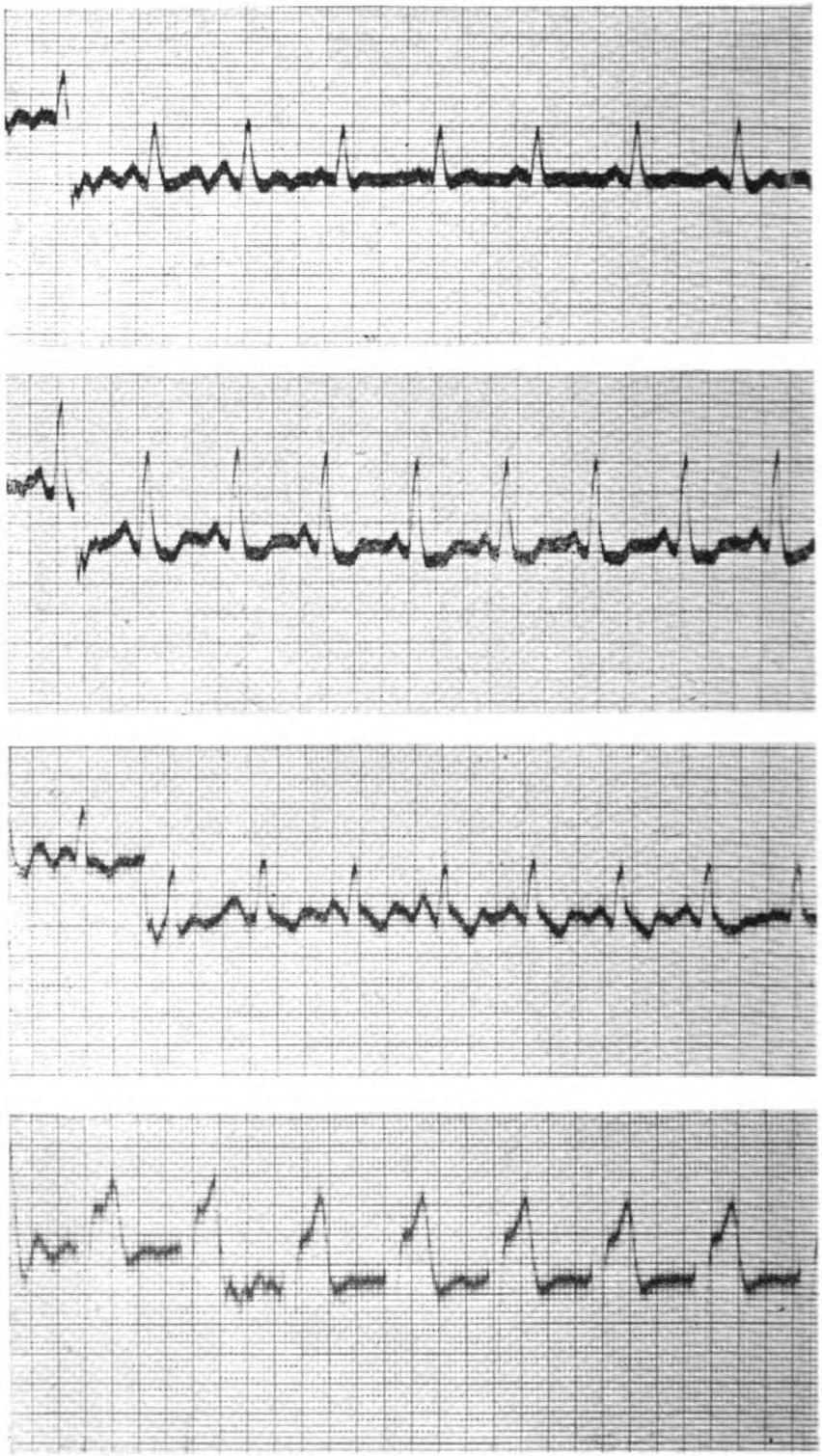


FIGURE 1.

a QRS interval of 0.08 second, upright T_1, and T_2, return toward isoelectric base line of S–T_4 and a smaller downward deflection (9 mm.) following the small R_4 (1 mm.).

A repeat electrocardiogram taken the day after the above reading was unusual. During the taking of the fourth lead, using a Cambridge string galvanometer

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machine with indifferent electrode over the apex, the string shadow was noted suddenly to show a wider excursion. At the same time, the patient complained of a sudden sharp pain in the precordium, lasting about 10 seconds. The patient stated later that the "pain did not amount to anything."

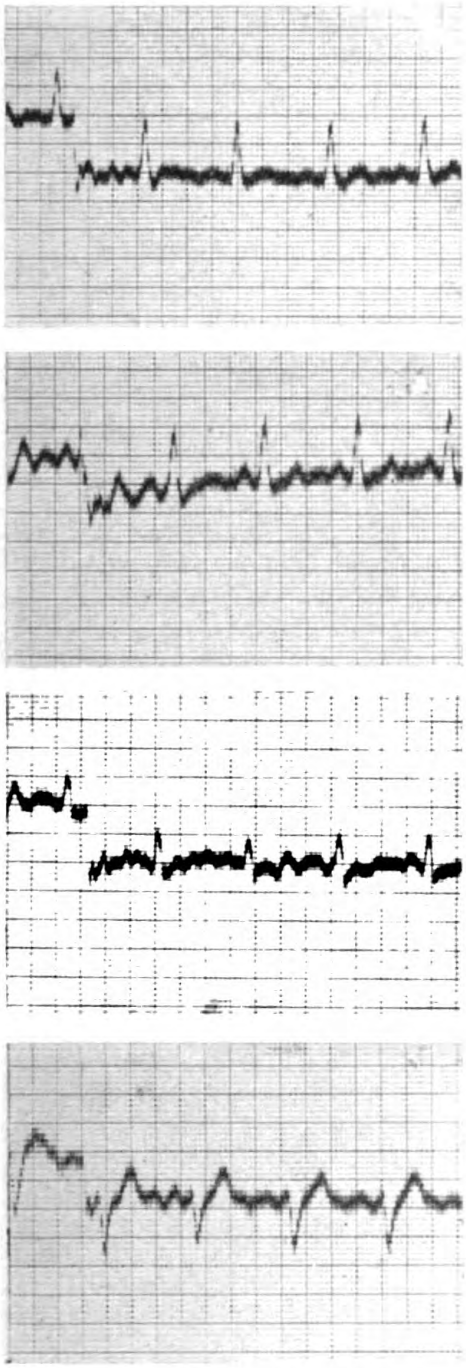


FIGURE 2.

The resulting tracing is shown in figure 3. Widening of the QRS interval to 0.12 second; increase in height of the T, slight depression of the S-T take-off, and lengthening of the downward deflection following the small R are seen (from 5 mm. to 9 mm.).

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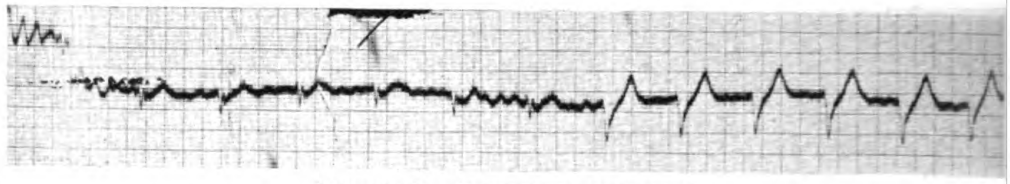


FIGURE 3.—Repeat of 4th lead.

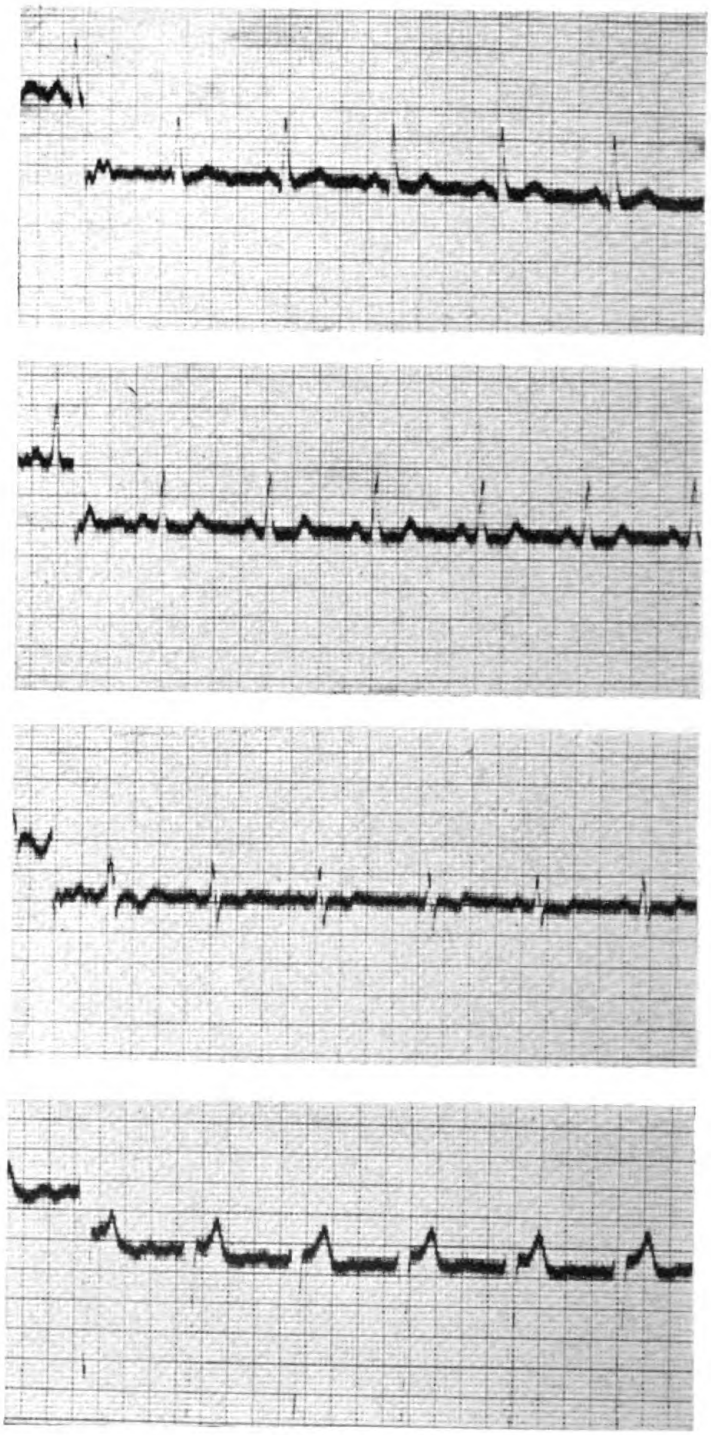


FIGURE 4.

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Another tracing was taken on the following day, and a remarkable change is seen, particularly in the fourth lead. There is again a

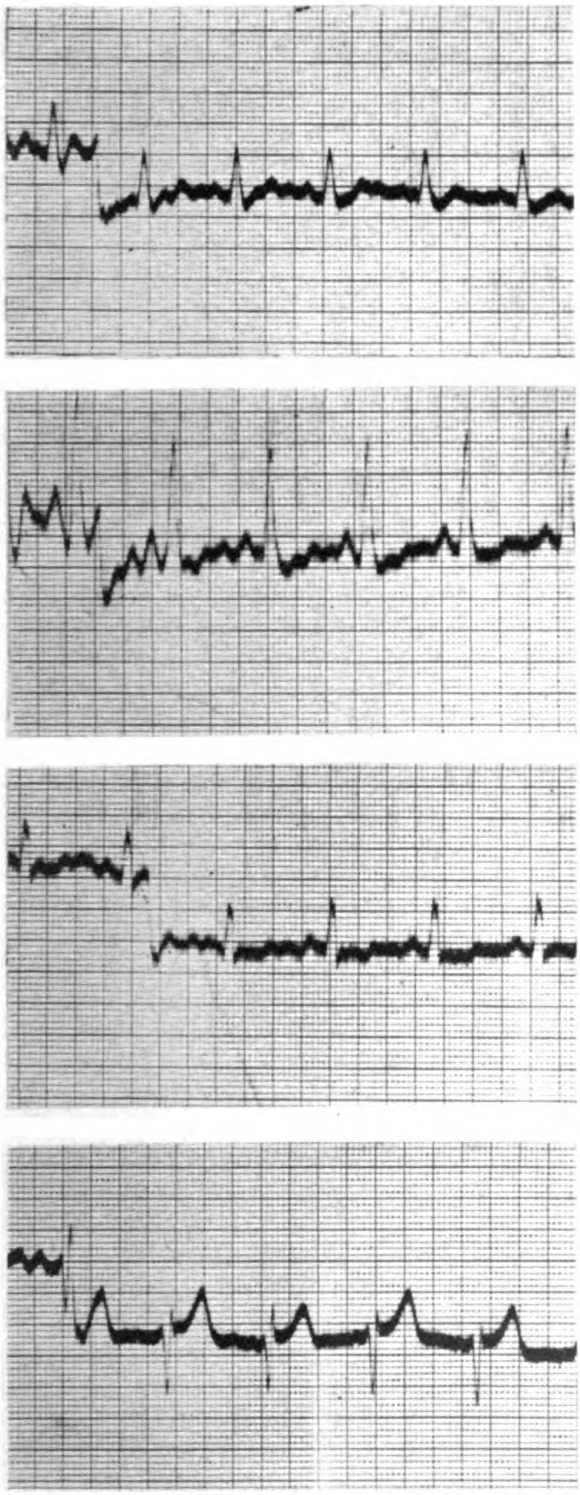


FIGURE 5.—Two months later.

deep (25 mm.) downward deflection following small R_4 (1 mm.), elevation of S-T junction and a change in the T wave configuration (fig. 4).

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The time of the patient's confinement to bed was consequently considerably extended. His excellent clinical progress is reflected in the fact that he has had no further attacks of pain or discomfort. An electrocardiogram taken 2 months later is shown in figure 5, the S_4 now being 7 mm. There is still a bundle branch block present (QRS–0.12 second).

This case is presented because of the rare and unusual good fortune which brought about the accident of recording a fourth lead at the onset of a precordial pain. That it was not a functional spasm is believed conclusively shown by the permanent changes which occurred in the tracings on the following day.

It may well be pointed out that fleeting precordial pain may be of great significance, as it was in this patient, and the possibility of further organic changes should be borne in mind constantly when such symptoms are present.

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VACUUM DRIED HUMAN SERUMS

Human serums dried in vacuo from the frozen state have been employed in passive immunization against measles, scarlet fever, whooping cough, mumps, and chickenpox, and in the treatment of scarlet fever and whooping cough.

With the exception of chickenpox, in which both convalescent and pooled adult serums frequently failed to protect, satisfactory results have been obtained. The results in mumps prophylaxis are not conclusive, but strongly suggest that serum may be of value.

Particular interest has been focused on the value of pooled normal adult serum in passive immunization against measles, and on the use of "hyperimmune" whooping cough serum in the prevention and treatment of that disease.

It would appear from these studies that serums dried in vacuo from the frozen state may be given either intramuscularly or intravenously with no more reaction than from injection of the same materials preserved in the liquid state; and the clinical results are comparable to those reported by other investigators who have employed similar serums preserved in liquid form.

Vacuum dried serums may be stored over long periods of time without deterioration and may be redissolved in a small fraction of their original water content, thus permitting concentration prior to injection.—McGuinness, A. C.; Stokes, J. Jr.; and Armstrong, J. G.: Vacuum dried human serums in the prevention and treatment of certain of the common communicable diseases—an 8-year study. Am. J. M. Sc. 205 : 826–834. June 1943.

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ACUTE SUPPURATIVE THYROIDITIS

REPORT OF A CASE

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Instances of acute suppurative thyroiditis are apparently uncommon. Boothby and Plummer reported 24 cases occurring between 1910 and 1932; in 12 of these there was no history of antecedent acute infection. Young found 26 cases of inflammatory disease of the thyroid gland in 2,900 thyroidectomies; of these 4 were abscess cases. Davis and Howell stated that suppuration occurred in one-third of all their cases of acute thyroiditis. Because of the rarity of this condition the following case is presented.

A 23-year-old man entered the hospital complaining of pain below his cricoid cartilage. Six weeks previously he had had an upper respiratory infection, during which he experienced tenderness of the right side of the neck at about the junction of the clavicle and the sternum. An antitetanus inoculation was given, immediately following which the neck tenderness increased and persisted for several days. Approximately 1 month later he noticed a slight swelling in the same area, which gradually extended over a period of several days to involve eventually the entire lower anterior cervical area. A few days before admission to the hospital he began to experience increasing and persistent difficulty in swallowing. There had been no noticeable change of heart rate or appetite. His past history was irrelevant.

Physical examination revealed a swelling of the neck in the region of the thyroid gland. The right and transverse lobes of the thyroid gland were hard, swollen, and tender. The patient's blood pressure was 124/70, his pulse rate 100, and his temperature 99° F. A complete blood count was within normal limits. Laryngoscopic and x-ray examinations disclosed no abnormalities.

Sulfanilamide was given orally, and hot moist compresses were applied locally. The swelling continued to increase so that within 2 days it was impossible for the patient to eat because of pain and difficulty in swallowing. The following day there was some clinical improvement. Subsequently, fluctuation and redness appeared over the isthmus of the thyroid gland. Three weeks later a small amount of purulent material was aspirated from the fluctuant area and 1 week later the abscess was drained. Culture of the aspirated and draining material was negative for bacteria.

The basal metabolic rate before operation was —16 percent. Daily administration of thyroid extract in ½-grain doses was started 1 week after operation and continued for 8 days, at which time the basal metabolism had fallen to —20 percent. The thyroid dosage was then increased to 1 grain daily. Because

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the basal metabolism had risen to —12 percent 6 weeks later, the thyroid extract was discontinued. The patient stated that without thyroid extract he felt fatigued, had a poor appetite and did not seem as mentally alert as while under thyroid medication. He was given several weeks' leave, and on return to duty his basal metabolic rate had fallen to —22 percent. Administration of thyroid extract was consequently resumed with a rise to —12 percent and marked subjective general improvement.

At present the patient is ambulatory and asymptomatic. The thyroid gland is firm and indurated. It moves with swallowing but is attached by scar tissue to the skin over the isthmus.

Sulfanilamide and sulfathiazole had no apparent influence on the course of the disease. Since x-ray therapy lessens the severity of the inflammation and incidence of suppuration in many inflammatory lesions, it might have been used here. Of special interest in this case is the prolonged period of suppuration, 76 days, and the marked improvement in physical and mental well-being with the daily administration of thyroid extract. Chemotherapy had little effect on the course of the disease.

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ETIOLOGIC AGENT OF PRIMARY ATYPICAL PNEUMONIA

The clinical syndrome currently known as primary atypical pneumonia may be caused occasionally by viruses of the psittacosis group or by Rickettsiae, but in the great majority of cases it is apparent that some other agent is responsible. Within recent months a number of investigators have reported attempts to isolate and identify this agent, which is presumably a virus.

Eleven patients severely ill with primary atypical pneumonia were selected for study.

In recently weaned guinea pigs 10 strains of a readily transmissible agent have been isolated from 7 of the 11 patients.

Pulmonary lesions appeared in the animals on first passage with two strains, on third passage with five strains, and on forth passage with the remaining strain. The agent produces a disseminated bronchopneumonia which becomes manifest grossly in from 12 to 20 days and shows complete resolution after 45 to 60 days. Successful transmission has been accomplished only by the intranasal route of inoculation.

The agent will pass through a Berkefeld V candle but is retained by filters of smaller porosity. It is unstable and deteriorates rapidly in saline suspensions at both room and ice-box temperatures, but may be protected by broth or normal serum. Potency is maintained for at least 6 months in the frozen state.—Rose, H. M., and Molloy, E.: Observations concerning the etiology of primary atypical pneumonia. Science 98: 112–114, July 30, 1943.

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CARCINOMA IN ROUTINE NAVAL PRACTICE

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and
EUGENE P. CRONKITE
Lieutenant (MC) U. S. N.

In the youthful, vigorous group of men with which one deals in the Naval service the possibility of malignancies is likely to be overlooked. In the first 705 surgical admissions to this hospital there were 3 cases of carcinoma. These cases are reported because they illustrate certain fundamental procedures that must be followed to prevent fatal blunders in the early diagnosis of cancer.

CASE REPORTS

Case 1.—An officer, 37 years old, entered the hospital with the diagnosis of polypus of the colon. There was no family history of carcinoma and the patient's past history was irrelevant. He complained of a dull, continuous ache in the region of the umbilicus. The pain had no relation to meals or bowel movements. There had been no nausea, vomiting, diarrhea, melena, or frank bleeding from the bowel.

Physical examination revealed a well nourished young man in apparent good health. There was no lymphadenopathy. Examination of the rectum revealed nothing of note. Blood and urine findings were normal. Stool examination showed the presence of 2-plus occult blood. X-ray examination by means of a barium enema showed a broad-based polypoid tumor of the ascending colon, subsequently confirmed at laparotomy. The terminal part of the ileum, the cecum, and the ascending colon were resected and an end-to-side anastomosis was performed. There was no metastasis in the liver or mesenteric nodes. Microscopic examination of the tumor showed that there was no extension into the serosal layer of the peritoneum. The pathologic diagnosis was adenocarcinoma of the colon. Two months after operation x-ray examination by means of barium enema showed good filling without any defects or signs of obstruction. A chest x-ray and bone survey revealed no metastases.

Case 2.—A 22-year-old seaman complained of rectal bleeding and frequency of bowel movements for the past 4 months. The patient's mother had had a malignant tumor of the uterus. The patient's illness began 8 months after his enlistment while he was stationed as a cook at a large shore station. His back began to ache while standing and upon lying down in bed. The following month he consulted a medical officer about passing blood from the rectum. The physician made a digital examination and diagnosed internal hemorrhoids. Later the patient complained of severe backache, rectal bleeding, and diarrhea but nothing was done about it. A month later he again complained of the same signs and

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symptoms, and the diagnosis of internal hemorrhoids was made without examination. Meanwhile the patient grew pale, tired, listless, and lost a great deal of weight. Bowel movements became more frequent and were often bloody.

When admitted to this hospital the patient was pale, blood was draining from the anus, and digital examination revealed a hard, fixed mass about 3 inches above the anus. Sigmoidoscopic examination disclosed an ulcerated mass typical of carcinoma. The patient became acutely ill and a mass appeared in the lower right quadrant of the abdomen. Because it was felt that the rectum had been perforated, an exploratory laparotomy was done. A pelvic abscess secondary to a perforation of the rectum was found and an extensive carcinoma of the rectum with metastasis to the pelvis. A palliative colostomy was performed together with local excision of the tumor.

Case 3.—A 48-year-old gunner came to the hospital for diagnosis and treatment because a tumor had been found in the breast upon a routine examination. His family and past histories revealed nothing relevant. His present illness began 1 year ago at which time he noticed a slight discharge from the left nipple and a small swelling in the breast. This was not painful. During the 2 months prior to admission the mass had become larger. There had been no weight loss.

Physical examination showed an irregular, ovoid, slightly tender mass in the left breast just lateral to the nipple. This mass was attached to the skin but not to the underlying tissues. The axillary lymph glands were not palpable in either axilla. There were no apparent signs of metastasis. Blood examinations yielded negative results, as did x-rays of the chest and bones. Surgical removal was advised. In a small sample of tissue removed for biopsy scirrhous adenocarcinomatous cells were found. A radical mastectomy was consequently performed. There was no gross or microscopic evidence of neoplasm in the overlying skin, the underlying muscles, or in the axillary nodes and adipose tissues. Following the patient's hospitalization there was no lymphedema of the arm, and motion and strength were very good. A subsequent physical examination together with x-rays of the chest and the bones revealed no abnormalities.

COMMENT

Case 1 emphasizes the necessity of taking x-rays promptly in the presence of abdominal complaints and demonstrates the good prognosis of early resection for carcinoma of the colon. Experience has shown that with stage 1, where the tumor is purely local, there is better than a 75-percent chance for a 5-year cure; in stage 2, where the tumor has extended to the adjoining tissues, there is a 60-percent chance for 5-year arrest; in stage 3, where the tumor involves local lymph nodes, a 15–20-percent chance; and stage 4, where there are distant metastases, less than a 5-percent chance for 5-year arrest (*1*).

Case 2 illustrates the consequences of late diagnosis of carcinoma of the rectum due to inadequate examination and care. In this case 1 month elapsed without the patient having benefit of medical treatment. It is noteworthy that the tumor arose at a point within reach of the ordinary finger. Eighty percent of carcinomas of the rectum are within reach of the finger; the other 20 percent can be visualized through the sigmoidoscope. Barium enema and x-ray are of little aid in diagnosis of lesions in the rectum, but of definite value for

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lesions above the rectum. A sigmoidoscopic examination was unduly delayed in this case. The necessity for adequate digital and proctoscopic examination is apparent regardless of the age of the patient.

The age incidence of carcinoma of the rectum and colon is of interest. The incidence of adenocarcinoma of the colon and rectum is 13 percent of all carcinomas. Of this number 5 percent occurs under 30, 10 percent between 30 and 40, and 85 percent over 40 years of age (*1*). A large percentage of all men under 40 will be in the armed services. A significant number of cases of carcinoma of the rectum and colon can therefore be anticipated.

Case 3 is typical of male carcinoma of the breast. The incidence of this tumor in the female is 20 percent of all carcinomas. In the male the incidence is much less than 1 percent. The diagnosis is simple. When one errs it is usually in making a diagnosis of carcinoma for a benign tumor, because the male breast is prone to show retraction and fixation of the nipple with almost any kind of tumor, infection, or a simple mastitis, a condition due to the fact that in the male the areola covers almost the entire breast (*2*).

Treatment is not nearly as successful in the male as in the female. In the former there is more rapid invasion of the underlying muscles, the intercostal lymphatics, and the axillary lymph nodes. The prognosis is poor. Radical mastectomy yields a 20 percent chance for 5-year survival and about a 5 to 10 percent chance for complete cure (*3*).

The prognosis in case 3 is good, largely due to early discovery of the tumor.

In summary, three cases of carcinoma are reported occurring in men of the younger age group. Two cases are apparent cures because of early surgical intervention.

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EPIDERMOLYSIS BULLOSA

REPORT OF A CASE

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Although the report of a case of a rare dermatologic condition is not ordinarily of great interest to naval medical officers, it is felt that the following described entity may be of importance at least from a differential diagnostic point of view.

Epidermolysis bullosa is an unusual skin condition characterized by the development of vesicles, blisters and epidermal cysts over points of trauma. The lesions usually appear early in life and occur most frequently on the extensor surfaces of the joints. The fingers, toes, ankles, and knees are most frequently involved. Occasionally lesions make their appearance later in life (the "acquired" type). In some cases the bullae are deep-seated and, on healing, leave atrophic and depressed scars (the "dystrophic" type). In others, the lesions are smaller, more superficial, and leave no trace (the "simplex" type). The appearance of the lesions is often preceded by a burning or stinging sensation. The bullae appear, rupture after a time, and leave a temporary or permanent scar depending on the depth of the lesions. Numerous areas may be involved. Occasionally only the feet or hands may be affected. Cockayne [1] reported two cases in which only the feet were involved, and recently Franks and Davis [2] reported a similar condition in an Army recruit.

In practically all the reported cases there has been a strong familial history of the same disorder. Aside from this familial tendency nothing is known regarding the etiology.

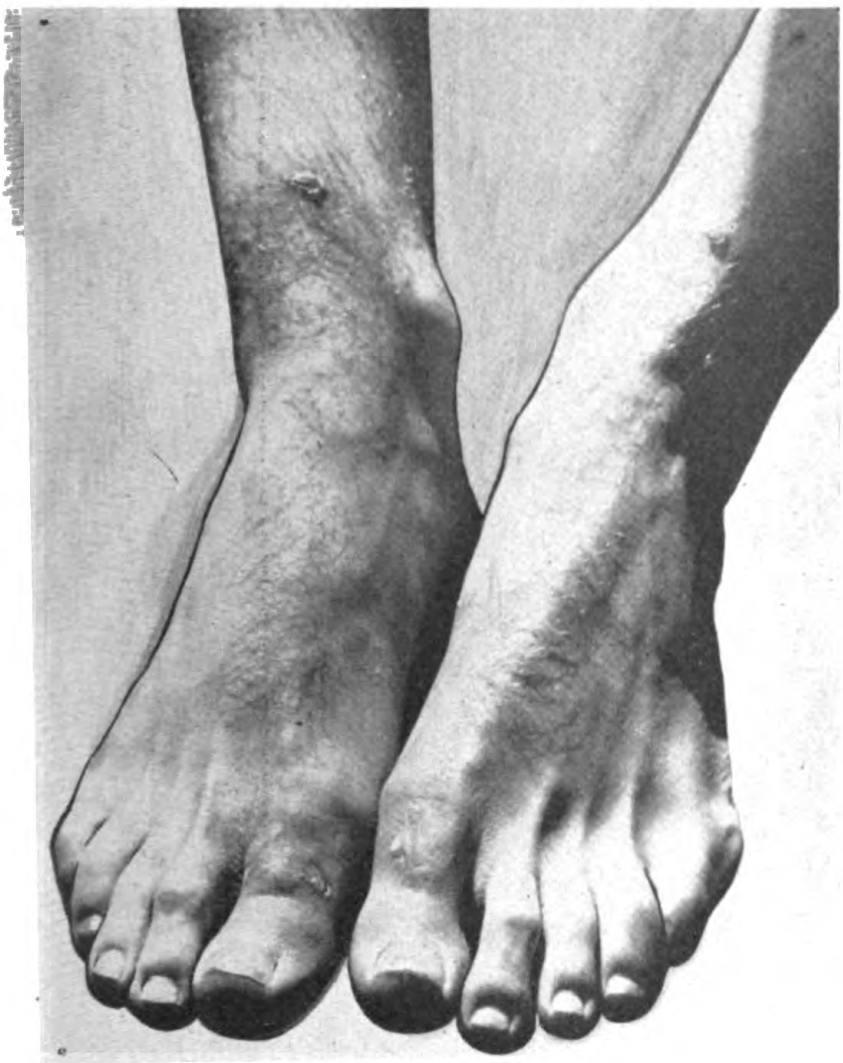
Microscopically the bullae may be superficial (intra-epidermal) or deep (between the epidermis and corium). A mild round-cell infiltrate is often present in the superficial corium. The most consistent pathologic change is a lack or paucity of elastic fibers in the superficial dermis. This deficiency can sometimes be demonstrated with special stains and apparently furnishes a mechanical reason for the easy splitting of the epidermal layer or the separation of the epidermis from the underlying corium. This change in the elastic fibers is not invariably present and has been disputed by several writers.

[1] Cockayne, E. A.: Recurrent bullous eruption of feet. Brit. J. Dermat. 50: 358–362, July 1938.

[2] Franks, A. G., and Davis, M. I. J.: Epidermolysis bullosa. Arch. Dermat. & Syph. 47: 647, May 1943.

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There is no known adequate therapy for epidermolysis bullosa. Such patients should simply be instructed to avoid trauma to the affected areas. The condition is of military interest since it incapacitates the affected individual for most military duties requiring marching or prolonged standing. Severe and extensive cases will be aggravated by even moderate physical activity.



1. Unruptured bullae on both ankles. These were due to pressure from upper edge of shoes.

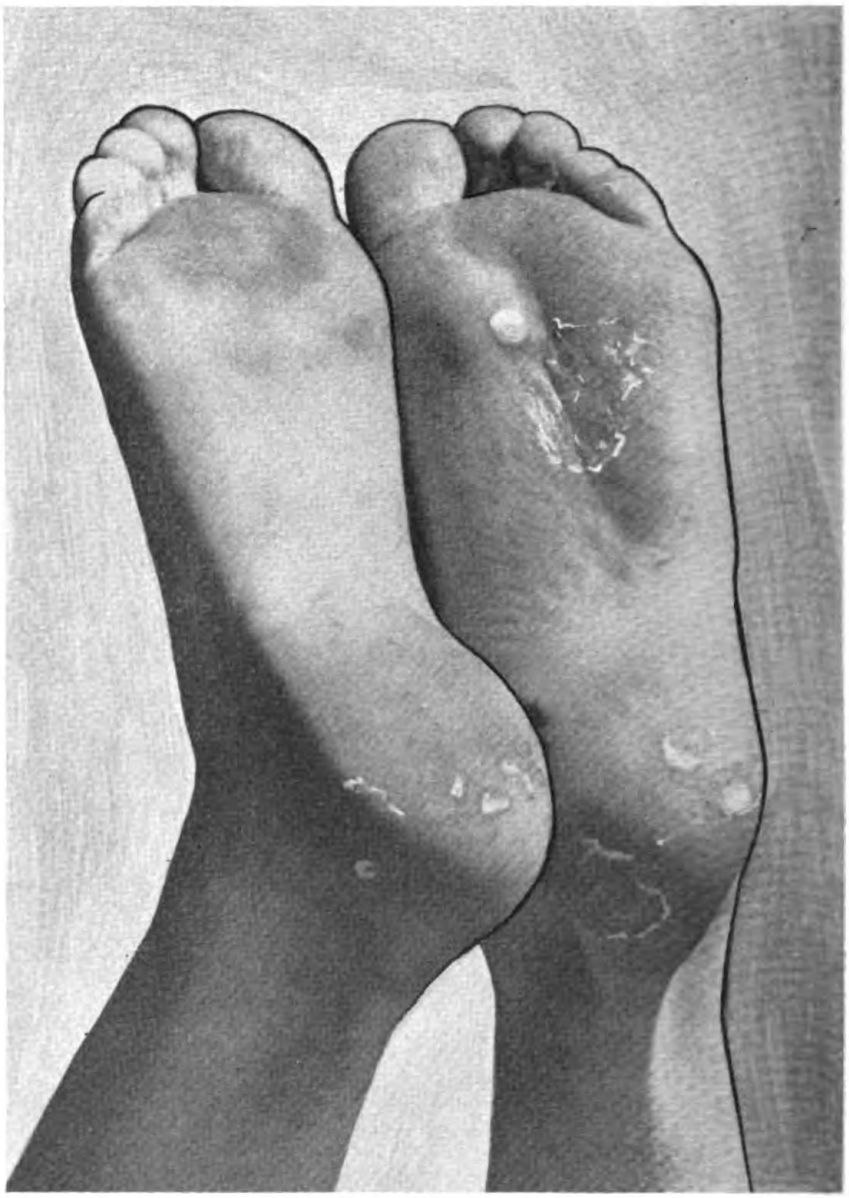
CASE REPORT

An apprentice seaman, 18 years old, reported to the dispensary after 5 days of recruit training. He complained of burning and swelling of his feet accompanied by blister formation. This had become progressively more severe with each drill period. He was referred to the hospital for diagnosis and treatment.

The following history was obtained on admission. As long as the patient could remember he had suffered from recurrent blisters on his feet, ankles, and

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hands following trauma or prolonged pressure. The appearance of the blisters was preceded by a sensation of stinging, burning, and swelling. No lesions had ever appeared on his knees or elbows. His general health had always been excellent but he was obliged to obtain sedentary employment since active physical work was soon followed by the appearance of lesions on his feet.



2. Deep seated unruptured bulla on left transverse arch. Recently ruptured depressed lesion on left heel.

The family history was interesting. Four sisters and two brothers were unaffected. His mother had suffered from the identical condition all her life. Of his mother's five brothers and four sisters, two brothers and two sisters were similarly afflicted. His maternal grandmother had the same disorder all her life. Further familial history was not obtainable.

Physical examination revealed a well developed young white male. Except for mild pharyngitis and the dermatologic findings, the examination was not revealing. Several small bullae on a slightly inflammatory base were present

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on both ankles at the level of the upper edge of the shoes (fig. 1). Recently ruptured bullae were noted on the dorsum of the feet and toes. Superficial slightly depressed scars of healed lesions were noted on the plantar surfaces bilaterally. Two deep thick-walled bullae were present on the left sole (fig. 2). One on the left heel had recently ruptured; the other on the transverse arch was still unruptured. Several superficial scars of old lesions were noted on both palms. The skin of the rest of the body was of normal appearance.

A biopsy of the lesion from the right ankle showed the bulla to be intra-epidermal, its floor being formed by the basal layer of epidermal cells, the roof consisting of the rest of the epidermis. A mild inflammatory reaction was noted in the corium. Sections stained for elastic tissue showed elastic fibers to be present in normal amount in the corium. Those present in the superficial papillary layer appeared to be somewhat thinned and fragmented. In a few places immediately beneath the bulla the fibers were scarce but not completely lacking. The pathologist considered the picture consistent with the clinical diagnosis of epidermolysis bullosa.

SUMMARY

A typical case of epidermolysis bullosa is described. This condition is of interest in that it must be differentiated from dermatitis venenata, acute dermatophytosis and other vesicular and bullous dermatoses involving the extremities. The history of chronicity, aggravation by trauma and familial occurrence should serve to distinguish this condition from others with which it might be confused. It is of military interest since its presence precludes the performance of any but the most sedentary duties.

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DUODENAL HEMORRHAGE IN FLIGHT

The patient was a pilot on one of the national airlines. He had had mild distress and gaseous distention over the upper part of the abdomen intermittently for several years. The eating of food had relieved these symptoms. At no time had the symptoms been severe enough for the patient to call attention to them or to consult a physician concerning them. In March, 1939 the patient slipped and jarred himself while climbing up into the cabin of his plane. In taking his position in the cabin, he noticed that he was somewhat weak and dyspneic. Despite these sensations he took his plane up, flew his regular flight a distance of 200 miles requiring 1½ hours, and landed the plane at its destination. During the course of the flight the patient felt feverish, later broke out into a cold sweat and marked palpitation of the heart developed. After landing his plane he reported to the flight superintendent, and fainted while giving his report. He was unconscious for a minute, and then regained consciousness and was able to drive his automobile home.—Tillisch, J. H.: Hemorrhage from duodenal ulcer in a pilot while flying; report of case. Proc. Staff Meet., Mayo Clinic, 16: 209–211, April 2, 1941.

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TRAUMATIC ANEURYSM OF THE ULNAR ARTERY

REPORT OF A CASE

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Traumatic arterial aneurysms of the peripheral vessels are rare lesions. Matas (*1*), in a review of the peripheral vascular injuries seen in World War I, found that traumatic aneurysms occurred in only 1 percent of the wounds of the extremities, and this included both the arterial and arteriovenous types. The incidence of true arterial or pseudo-arterial aneurysms was much more rare.

The following example of a sacciform pseudo-aneurysm of the ulnar artery is reported because it seems highly probable that lesions of this type may be seen with increasing frequency during this present conflict.

CASE REPORT

An apprentice seaman, 24 years of age, was admitted to the hospital complaining of a firm, tender mass in the hypothenar region of the left palm.

Four years previously the patient sustained a puncture wound in this area from a long spear of glass. The wound was closed by suture and promptly healed. One month later a small firm mass became palpable beneath the site of injury, and had persisted to the present time. During the last 3 years there had been only a slight increase in the size of the mass, but associated tenderness had gradually reduced the strength and usefulness of this hand in heavy manual work. In recent months pain and numbness in the distribution of the ulnar nerve had become an added feature.

The physical examination was essentially negative except for the left hand. There was a firm oval-shaped mass, 2 by 1 cm. in size, palpable in the soft tissues of the left palm just distal to the ulnar styloid. This mass was definitely pulsating in type and it was felt to be expansile rather than transmitted. There was no motor or sensory loss in the distribution of the ulnar nerve. The circulation to all the digits appeared entirely normal. A blood-pressure cuff applied to the arm promptly obliterated all pulsation in the mass, but elevation of the extremity did not result in an appreciable reduction in its size.

A diagnosis of traumatic aneurysm of the ulnar artery was made and surgical excision advised.

An 8-cm. incision was made along the medial aspect of the left hypothenar space, the proximal one-third of the incision being carried medially in the crease at the base of the hand. This triangular skin flap was reflected laterally, exposing the palmar fat pad. Lying in the deeper layers of this fat an aneurysmal sac 2 by 1 by 1 cm. was identified and carefully exposed. The ulnar artery and vein both entering and leaving the aneurysm were intimately fused together and surrounded by a plexus of very small veins. The ulnar nerve was firmly adherent to the medial side of the sac. The major trunk together with

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its first branch were carefully freed without injury. The vessels entering and emerging from the aneurysm were doubly ligated without making an effort to separate the artery and vein, and the sac removed. The wound was closed with cotton sutures and a firm pressure dressing applied.

Convalescence was uneventful except for some numbness and tingling in the distribution of the ulnar nerve, which persisted for approximately 3 weeks. The circulation in the hand remained entirely unimpaired. The wound healed by primary intention. Guided active movements of the hand and fingers were encouraged after 10 days. The patient returned to duty 1 month following operation.

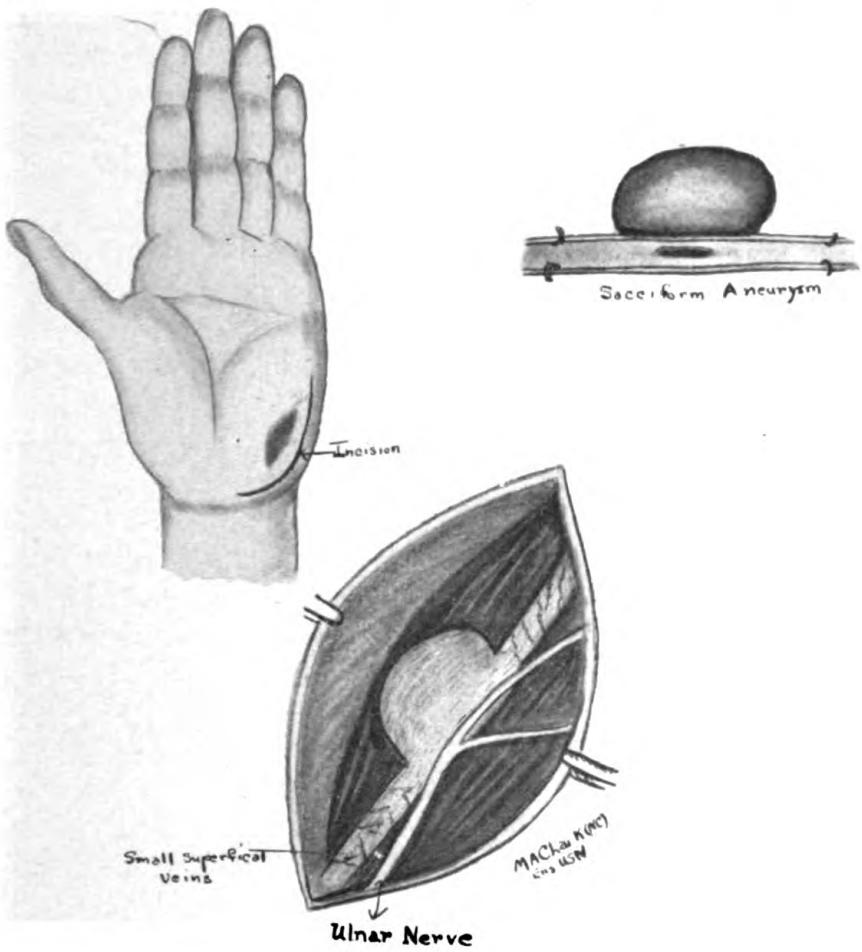


FIGURE 1.

Examination of the specimen after removal disclosed a true sacciform pseudo-aneurysm of the ulnar artery, the accompanying vein being uninvolved. There was a 4 by 1 mm. opening in the lateral wall of the ulnar artery, connecting with the aneurysmal sac, the capacity of which was approximately 3 cc. This opening in the arterial wall undoubtedly resulted from the initial puncture wound 4 years previously. The periarterial hematoma became organized and sacculated by the persistent arterial pulsation, with resultant formation of a pseudo-arterial aneurysm of the sacciform type. The dense

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palmar fat and overlying skin above and the metacarpal bones beneath offered sufficient resistance to prevent continued enlargement of the aneurysm.

COMMENT

Gage (*2*), in a recent discussion of traumatic arterial aneurysms, differentiates between true arterial and pseudo-arterial aneurysms on the basis of arterial muscle elements in the wall of the sac. He states that when a sharp object, such as a knife or glass, penetrates one side of a peripheral artery, the extravascular hematoma may become organized into a definite fibrous aneurysmal sac in approximately 6 weeks. There results a pseudo-arterial aneurysm in whose walls no arterial muscle can be demonstrated; the case here reported falls into this group.

Robb, McKechnie and Guthrie (*3*) have recently reported a very similar case in a young girl, following a palmar puncture wound from a splinter of glass. Moreover, it is stated that two other aneurysms of the ulnar artery, both due to falling upon glass with the hand outstretched have been seen. The first case was thought to be fibrous tissue about buried glass until exploration was undertaken, while in the second a correct diagnosis was made before surgery. Except for this report no other cases have been found in the recent available literature.

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BARBITURATE EFFECT ON FLUID LOSS

Experiments done on chickens, rabbits, and young pigs rendered insensitive to pain showed that pentobarbital sodium given intravenously significantly decreased the amount of fluid lost from burnt surfaces as determined by differences in weight. The mode of action of the barbiturate is not clear; it may act by either causing a reduction in capillary filtering surface or in capillary pressure. Morphine was not as effective as the barbiturate.—Beecher, H. K., and McCarrell, J. D.: Reduction of fluid loss from damaged (burned) tissues by a barbiturate. J. Pharmacol. 78: 39, 1943.

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THE MEATAL CHANCRE

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The relatively frequent occurrence of a syphilitic chancre in the meatus presents a distinct hazard for the syphilitic patient. Its clinical appearance is misleading, since it does not correspond to the chancre occurring in other parts of the body. Almost always the patient consults a physician for a slight serosanguineous urethral discharge that has existed from 2 to 10 days. As a rule the disease is diagnosed as a mild form of gonorrhea or a recurrence of an old gonorrhea, because of the absence of pain and the presence of this mild type of discharge. It is also not infrequent to find in a case of frank gonorrhea that a thin and scanty serosanguineous discharge appears after the heavy creamy discharge has cleared up. This finding should always make the physician suspicious that he is dealing with a mixed infection of syphilis and gonorrhea.

In order to recognize this form of chancre it is necessary to explore the meatus and the navicular fossa very carefully. Induration of the lesion, which has such an uncertain value in diagnosing chancres in other locations, is here *a sign of utmost diagnostic importance.* This induration, which is almost always located on one side of the urinary canal, can be readily felt by holding the penis between the thumb and forefinger and palpating it in an anteroposterior direction. A pseudocartilaginous resistance to the palpating fingers, of about the size of a dime, will be made out deep in the mucous membrane. As the chancre ages, the thickening gradually enlarges until the orifice may be completely occluded, making urination impossible. Modern antisyphilitic therapy causes this induration to disappear quickly from this region. The glands in the inguinal region are hard and enlarged. Curiously enough, although the lesion feels distinctly unilateral, the glands on both sides of the inguinal region may be involved. There is no deep glandular enlargement. Usually more than one gland is felt on each side.

Once our attention has been directed to the possibility of the lesion being syphilitic the diagnosis of this chancre, like the diagnosis of a chancre in any other location, is no longer a clinical problem. The clinical suspicion should be verified by repeated darkfield examinations. In a long-standing (3 to 6 weeks) unrecognized case of meatal chancre a "pipe stem" lymphangitis of the dorsal lymph channel of

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the penis develops, and on squeezing the penis laterally there occurs only a slight "pouting" of the meatus, indicating induration. Scraping the end of the penis will give a positive darkfield finding. The meatal chancre in its earliest stages may have the exact appearance of an abortive type of herpes genitalis located partially in the meatal opening and partially on the surrounding surface. All such lesions should be subjected to immediate and repeated darkfield examinations.

Let me repeat again that the diagnosis of a syphilitic chancre, no matter where it occurs, is no longer a clinical problem. The diagnosis should be made by the laboratory.

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TREATMENT OF ACUTE TONSILLITIS

Series 1 consisted of 65 cases treated with bed rest, sulfathiazole grains 30 on admission and grains 15 at 4-hour intervals until the temperature was normal for 24 hours. Warm saline gargles were given every 2 hours. In this group the maximum temperature on admittance was 103.4° F., the minimum 99.2° F., with an average of 101.4° F. for all cases. The highest temperature reached by any case was 104.2° F. The shortest number of hospital days was 2 and the longest 9, with an average of 3.01 days for the group. There was 1 complication (peritonsillar abscess) which developed on the 4th day. This was incised and the patient returned to duty on the 9th day. There were 2 recurrences of sore throat and high temperature within 24 hours after initial discharge. Sixty-five percent of cases in this group complained of dizziness, light headedness, and weakness and had to be restricted to light duty for 2 days before resuming full duties.

Series 2 consisted of 65 cases treated with bed rest, APC capsules, 2 every 4 hours until the temperature was normal for 24 hours. Warm saline gargles were given every 2 hours. The maximum temperature on admittance was 103° F. and the minimum 99° F. The average was 100.6° F. The highest temperature reached in any case was 105° F. The shortest number of hospital days was 1 and the longest 6, with an average of 3.12 days. In this group there were no complications and no recurrences. These men returned to full duty immediately on discharge.

Series 3 consisted of 12 cases where Vincent's organisms were predominant. These cases were treated with neoarsphenamine 0.6 gm. intravenously and perborate gargles every 3 hours. APC's were given for temperature. Temperatures ranged from 103° F. on admittance to 99° F. with an average of 100.5° F. Hospital days were a minimum of 1 to a maximum of 6, with an average of 2.91 days. These cases were all discharged with negative smears.—Dehnert, Ernst F., Lieutenant (MC) U. S. N. R.

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REFRIGERATION ANESTHESIA IN LEG AMPUTATION

SAMUEL PERLOW
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Local cold applications have been used in medicine since the earliest times. Hippocrates recommended them for injuries and fevers, and a century ago cold brine mixtures were used to relieve the pain and slow the growth of accessible cancers. The value of cold packs in the treatment of birthmarks and basal cell carcinomas and for the relief of pain due to injuries is demonstrated daily.

Recent investigations have extended the use of reduced temperatures in medicine. Smith and Fay (*1*) found that reduced local temperatures not only brought about marked relief of the pain of inoperable cancers of the uterus and the breast but also caused the tumor to shrink in size, and in several instances complete disappearance of the local growth resulted. There was no injury to the surrounding normal tissue. These experiments, and the work of Allen and his coworkers (*2*) (*3*) (*4*) (*5*) (*6*) on the use of cold applications in the treatment of gangrene and inflammation of the extremities, have been important contributions in their respective fields. Still more recently Blalock and Mason (*7*) demonstrated the value of refrigeration in traumatic shock, and Talbott and Tillotson (*8*) reported encouraging results of hibernation in some of the dementias.

The terms "refrigeration," meaning reduction of the local temperature by cooling to about 5° C., and "hibernation," meaning reduction of the general body temperature by cooling to about 30° to 35° C., were coined.

It is in its ability to produce local anesthesia and to prevent shock that refrigeration has proved most valuable in surgery of the extremities. Allen and his coworkers reported the use of refrigeration anesthesia for 57 amputations in 45 patients suffering from gangrene and cellulitis due to peripheral circulatory disturbances. There were 7 deaths, an operative mortality of 12 percent. This relatively low mortality in poor-risk patients they attribute to the prevention of shock and postoperative complications by the refrigeration. Anesthesia was complete in all of their cases and no supplemental anesthesia was necessary. The patients were not exposed to the dangers of general anesthesia and there were few pulmonary complications. There was practically no postoperative shock. The patients were in good condition immediately after the operation and in most instances were able to eat the next regular meal.

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In diabetic patients refrigeration was particularly valuable because there was no disturbance of the glucose-insulin balance. The postoperative course was smooth in most of the cases, although wound healing was somewhat slower than when refrigeration was not used. McElvenny (*9*) and others report similar results.

Method of applying refrigeration.—The site of the amputation is determined and the skin of this area is chilled by means of an ice collar for 15 to 30 minutes to produce sufficient skin insensibility to permit application of a tourniquet without pain. The tourniquet is a gum-rubber tube one-half inch wide applied to the extremity tightly enough to shut off the arterial and venous circulation. The extremity is then packed with ice to a point about 2 inches proximal to the tourniquet and is wrapped in a rubber sheet. The head of the bed is raised slightly to permit the water to drain into a bucket at the foot of the bed.

The temperature of the water and of the skin of the ice-packed extremity remains at about 4° to 5° C. The ice should be chipped. In no case should dry ice or carbon dioxide snow be used because of the danger of freezing the skin and causing tissue destruction. The duration of refrigeration necessary for complete anesthesia varies with the thickness of the extremity, from 1½ hours in the case of a leg to about 5 hours for a moderately muscular thigh.

In the operating room the ice is removed and the extremity quickly prepared for operation. Allen recommends that the amputation be performed through a skin incision distal to the tourniquet. The tourniquet is removed after the main vessels are ligated. The sponges used during the operation should be moistened in cold sterile water so that the tissues are not warmed. The anesthesia obtained ordinarily lasts for about an hour after the removal of the ice. After the operation the stump can be kept cool by placing ice bags about the dressings for several days to decrease the serous discharge and postoperative edema and to prevent pain.

CASE REPORTS

Case 1.—A 64-year-old man was admitted to a civilian hospital with which the writer was associated, because of pain and bluish discoloration of the left foot of 2 weeks' duration. He was a chronic severe diabetic. The foot was cold, and cyanotic to the ankle. All arterial pulses were absent from the knee down and the oscillometric index was 0 at the calf. The heart was enlarged and an electrocardiogram revealed evidence of recent coronary thrombosis. The patient's blood pressure was 190/80, the concentration of blood sugar 180 mg. per 100 cc. During the next 7 days the diabetes was controlled with diet and insulin, but the condition became worse and gangrene developed in the third toe. The patient became incontinent and stuporous and his temperature rose to 101° F.

Ten days after admission a left supracondylar amputation was performed after 5 hours of refrigeration of the extremity to the midthigh. At operation there was slight sensation when the sciatic nerve was clamped. This was relieved by 2 cc. of 2 percent procaine hydrochloride injected into the nerve.

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The refrigerated tissue looked healthy and bled somewhat less than usual. The operation was performed in the usual manner and the wound was loosely closed. The pulse varied between 64 and 90 and the blood pressure between 160/90 and 140/84 during the operation. A transfusion of 500 cc. of citrated blood was administered immediately following operation.

The patient was able to eat his next regular meal. The diabetic balance was not disturbed by the operation. The post-operative course was uneventful except for several small areas of gangrene of the skin flaps which sloughed spontaneously. The wound healed completely in 4 weeks.

Case 2.—A 77-year-old woman was hospitalized because of gangrene of the left foot of 6 weeks' duration. She was emaciated and in poor general condition. The foot was gangrenous to the ankle. All arterial pulsations were absent below the femoral artery and the oscillometric index was 0 at the calf. Her temperature varied between 99° and 101° F. The following day a left supracondylar amputation was performed after 3 hours of refrigeration. The tourniquet was placed just above the knee and the ice pack extended to the midthigh. Anesthesia was complete, but 2 cc. of 2 percent procaine hydrochloride was injected into the sciatic nerve before it was cut. There was very little bleeding during the operation. The patient's pulse varied between 84 and 106 and the blood pressure between 150/76 and 180/70. A transfusion of 500 cc. of citrated blood was given postoperatively. There was no postoperative shock. The patient made an uneventful recovery and was discharged on the 9th postoperative day with the wound completely healed.

Case 3.—A 67-year-old woman was admitted to the hospital because of rapidly spreading gangrene of the right foot. She was in poor general condition, markedly dehydrated, and toxic. The next day her temperature rose to 103.6° F. and there was evidence of spreading lymphangitis. Moist gangrene involved the whole foot. The dorsalis pedis and posterior tibial pulsations were absent.

The extremity was packed in chipped ice to the midthigh and a tourniquet placed just above the knee. Dextrose and saline solution was administered intravenously. In 10 hours the temperature had dropped to 99° F. and her general condition had improved markedly. Two hours later a supracondylar amputation was performed under refrigeration anesthesia. Anesthesia was complete, but 2 cc. of 2 percent procaine hydrochloride was injected into the sciatic nerve before it was cut. The patient's pulse varied between 90 and 108 and the blood pressure between 184/86 and 174/78 during the operation.

A transfusion of 500 cc. of citrated blood was given immediately after operation. There was no postoperative shock and the patient was able to eat her next regular meal on return from the operating room. She made an uneventful recovery. The wound was healed in 20 days and the patient was discharged on the 27th postoperative day.

Case 4.—A 68-year-old woman was admitted to the hospital because of gangrene of the right big toe. She was a diabetic of long standing. One year previously her left leg had been amputated above the knee for gangrene of the foot. She was in poor general condition and there was electrocardiographic evidence of coronary heart disease. The big toe was gangrenous, arterial pulsations were absent below the femoral artery, and the oscillometric index at the calf was one-half. The concentration of sugar in the blood was 144 mg. per 100 cc. The condition became gradually worse and because the patient would permit only a local operation, a Lisfranc amputation was performed 20 days later. A general anesthetic was used. The postoperative course was uneventful but the wound refused to heal and the foot became gangrenous. However, the patient refused to

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permit a higher amputation until the following month, when her condition was much worse and her temperature was 102° F.

A supracondylar amputation was performed after 3 hours of refrigeration. Anesthesia was complete, but 2 cc. of 2-percent procaine hydrochloride was injected into the sciatic nerve as an added precaution. The pulse varied between 90 and 96 and the blood pressure between 128/80 and 104/76 during the operation. A transfusion of 500 cc. of citrated blood was given immediately following operation. The patient was in good spirits after the operation and her pulse and temperature were normal until the 9th day when the temperature rose to 101° F. The next day 1 ounce of pus was evacuated from the wound. The skin edges were healed. From that time on her general condition grew worse, the wound became grossly infected, and the patient became incontinent. Somewhat later a decubitus ulcer developed and a complicating pyelonephritis, and shortly thereafter the patient expired.

COMMENT

In case 1 refrigeration anesthesia was used because of the patient's poor general condition and the presence of coronary thrombosis. He withstood the amputation without shock and was able to resume the diabetic regime the same day. Areas of necrosis, however, appeared at the edges of the skin flaps. The skin incision was made distal to the tourniquet as recommended by Allen and it seems that this may have been a factor in causing the flap necrosis. In subsequent amputations we placed the tourniquet just above the knee and applied the chipped ice to a point about 6 inches proximally on the thigh, making the skin incision proximal to the tourniquet. Since this method was used the skin flaps have not sloughed. Circulating blood in the refrigerated tissue proximal to the tourniquet did not alter the completeness of the anesthesia obtained and did not cause undue chilling of the body.

In case 3 the extremity was packed in ice and a tourniquet was applied for 12 hours before amputation. The pain associated with the gangrene and inflammation was relieved within 1 hour after refrigeration was started and the fever subsided in 10 hours. The nature of the operation was changed from an emergency in a toxic patient to one of election in a patient in fair general condition. She was able to undergo the amputation without shock and made an uneventful, rapid recovery.

The appearance and consistency of the tissues in our cases at operation was that of chilled meat. No vascular thrombosis was noted, and sections of the femoral vessels showed no microscopic changes that could be attributed to refrigeration. There was less than the usual amount of blood loss. The pulse and blood pressure remained practically unchanged during the operation in all of our cases, and there was no noticeable postoperative shock as is commonly observed following amputations done with a general or spinal anesthetic even when blood transfusions are given. There was very little postoperative pain

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or edema of the stump. The wound healed completely in 9 days in one of our cases (case 2), but somewhat more slowly than usual in the other cases. Our patients were able to eat the next regular meal on returning from the operating room. In the diabetics the balance was easily maintained.

Our results with refrigeration anesthesia in these few extremely poor-risk cases were satisfactory. We believe that this type of anesthesia fills a definite need in surgery of the extremities. It is a useful procedure for relief of pain and toxemia due to inflammatory conditions, crushing injuries, and gangrene of the extremities, and as a means of anesthesia for leg amputation in debilitated patients and those in shock.

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DUTY STATUS FOLLOWING AN INDUCED EMOTIONAL STATE

REPORT OF A CASE

LAWRENCE C. KOLB
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The feasibility of returning to sea duty men who have suffered a war neurosis (combat fatigue), or a traumatic neurosis induced by some seafaring experience, with reasonable assurance of their carrying on, has not been fully appreciated. Margolin, Kubie, Kanzer, and Stone (*1*) have pointed out that many merchant seamen resumed their occupation in spite of the fact that they had suffered symptoms of an emotional disturbance following torpedoing at sea.

A number of patients under my observation in this hospital survived combat action, including the loss of the vessel on which they had served. They developed symptoms of restlessness, startle, catastrophic nightmares, irritability, anxiety, and some personality change characteristic of combat fatigue. They had, however, returned to sea on combat ships, where they performed creditably in further action against the enemy.

A chief petty officer, 43 years of age, was transferred to the hospital from the receiving station for treatment for general nervousness and tremulousness. He had been saved by a breeches buoy from the wreck of a supply ship which went aground in a gale 2 months previously. He was one of the last to leave the ship. He saw many of his shipmates washed overboard, while others drowned in a vain attempt to swim ashore. He himself was exposed to many hours of tension, rigging and assisting in the operation of the buoy. On being hoisted from the beach to an overhanging cliff he was blown against the cliff and knocked unconscious. For 36 hours thereafter he was exposed to extreme cold.

During the 3 weeks prior to his transfer to this country his sleep was restless and broken and he had a constant daily headache. On landing in the States he was met with frantic inquiries by relatives of the men lost at sea. Suddenly he became extremely tense, restless, and anxious to the point that he could only find relief in drinking. On admission to this hospital no evidence of instability could be ascertained in a careful review of his past personal history. The physical, neurologic, and laboratory examinations failed to disclose organic disease. He was conspicuously tremulous, fearful, and apprehensive when first interviewed and piteously begged not to be pushed or questioned concerning his recent horrifying experience. The necessity for so doing was explained to him but psychocatharsis could not be obtained immediately.

At a second discussion he was brought to relive his experiences by a verbal description. His tension was accentuated. He was observed to be more

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tremulous, to sweat profusely, and he brought out his story with hesitation and only after much probing. He admitted that questioning by the idly curious had been extremely irritating to him and that his only means of escaping his continual preoccupation with these horrifying memories was by drinking. The patient was interviewed daily, after which his sleep became sound. In the last 10 hospital days he was allowed full privileges and did not again resort to alcohol.

The patient returned to duty under the impression that he would be given a period of shore duty. Much to his surprise he was placed aboard an oil tanker. In convoy the ship was subjected to no less than eight submarine attacks. The patient prided himself upon his own composure and self control during those trying times, claiming only an average amount of tension. After 6 months at sea he was transferred to a shore station. At the end of a 1-year period he was promoted to chief warrant officer.

The above case illustrates several points that were recently brought out by Raines and Kolb (*2*):

1. This type of emotional disturbance may occur in individuals of lifelong stability, as well as complicate the disease picture of those who previously suffered other nervous or mental disorders or were known to be temperamentally unstable.

2. The symptoms are often acutely aggravated following return home, where the individual is exposed not only to the ministering influence of his own family but also to the disturbing inquiries of others.

3. Improvement quickly follows simple psychotherapeutic discussions designed to desensitize the patient to the painful emotions attached to his traumatic experience, provided that he is not of long-standing neurotic temperament.

The case is instructive in yet another way as it illustrates the similarity between a traumatic neurosis induced by shipwreck, and the so-called war neurosis or combat fatigue, both in the symptomatology and the prompt recovery in the stable individual.

The ultimate performance of men who develop such acute emotional disturbances and are returned to duty, may be learned only by accurate follow-up of such individuals. It is not sufficient for physicians reporting on the handling of such cases to state the percentage of patients returned to duty. What happened to these individuals is important, particularly their behavior in combat duty.

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VERMIFORM APPENDIX IN INGUINAL HERNIAL SAC

A REPORT OF 3 CASES

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That the appendix may be present in the contents of hernias has long been known. DeGarengrot recorded the first case in 1731. In 1938 Ryan collected 537 cases. Figures show that this complication occurs most frequently in right inguinal hernias, but left inguinal and femoral hernias are not exempt. The incidence of finding the appendix in a hernial sac has been reported as being from 0.19 to 1.7 percent.

Acute hernial appendicitis is not such a rarity. The most striking feature of the literature is the almost complete uniformity with which the diagnosis is missed. Inasmuch as strangulated hernia—the condition with which it is most frequently confused—is universally recognized as an acute surgical emergency, the error is probably not serious.

Congenital weakness in the structure of the peritoneal sheaths enclosing the cecum is an important predisposing factor in the etiologic association of the vermiform appendix with an inguinal hernia. This finding of necessity must be dependent upon a low position and a definite degree of mobility of the cecum and appendix. The exciting factor in many cases is a condition of a sliding hernia.

At this dispensary in only 3 cases among 750 patients operated upon for inguinal hernia was the vermiform appendix present in the hernial sac. These 3 cases gave no history of abdominal pain serious enough to consult a physician, and 1 of them did not know he had a right inguinal hernia until examined in the recruit line. The finding of the appendix in the hernial sac was incidental and not suspected before operation. All the patients had a rather uneventful postoperative course and were discharged to duty without incidence.

CASE REPORTS

Case 1.—An apprentice seaman, 19 years old, was admitted to the dispensary for repair of right inguinal hernia. The patient had known for the past 5 years that he had a hernia and had noticed its change in size from time to time. There was no history of pain, nausea, or vomiting, and physical examination revealed no other finding.

At operation the sac on opening revealed a moderately inflamed appendix adherent by the meso-appendix to the sac wall throughout the entire length. The appendix was dissected free and excised. The hernial sac was then com-

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pletely removed after ligation of its neck. The operation was completed according to the Bassini technic using cotton sutures.

The postoperative course was uneventful. On day of discharge examination revealed a well healed operative scar with no evidence of hernia and no tenderness in the right lower quadrant of the abdomen.

Case 2.—An apprentice seaman, 19 years old, was admitted to the dispensary for repair of a right inguinal hernia. The patient denied previous knowledge of hernia and there were no referable symptoms. Other physical findings were negative.

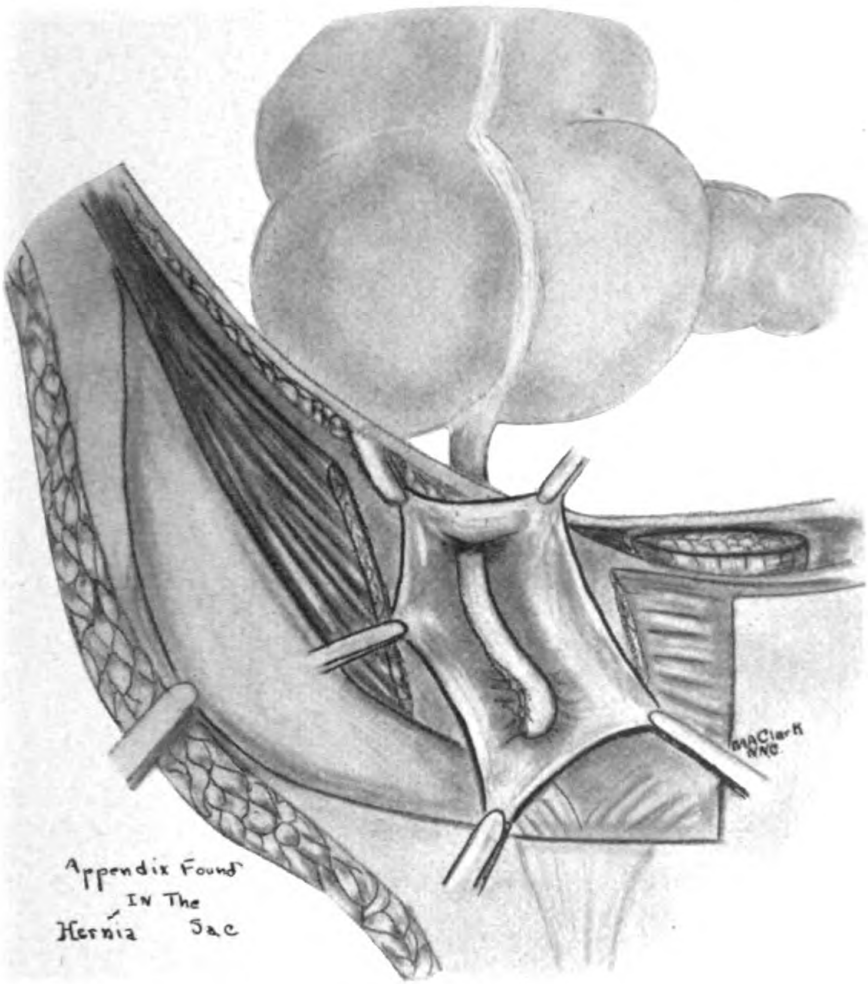


FIGURE 1.

At operation the hernial sac was freed and opened. A normal appendix was found within the sac, adherent by the meso-appendix. A routine appendectomy was performed. The hernia was then repaired according to the Bassini technic.

The postoperative course was normal. Examination on day of discharge revealed a well healed operative scar, no evidence of hernia, and no tenderness in the right lower quadrant of the abdomen.

Case 3.—An apprentice seaman, 25 years old, was admitted to the dispensary for repair of a right inguinal hernia. The patient had known he had a hernia for the past 4 years, but had had no specific complaints referable to it. Other physical findings were irrelevant except a Vincent's infection of the throat.

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The patient was treated successfully for his throat complaint and returned to the surgical service. Repeated Kahn tests were negative.

At operation a small hernial sac was found, the posterior peritoneal surface of which was formed by the blind portion of the cecum. The cecum was drawn down revealing a large thickened appendix measuring 1 cm. in diameter. The cecum was attached to the cord on its retroperitoneal surface. The cord was separated and the appendix was removed. The peritoneal defect was closed with a purse string suture. Sulfanilamide was placed into the wound and the hernia was repaired by a modified Halsted method.

The postoperative course was normal. Examination on day of discharge revealed a well healed operative scar, no evidence of hernia and no tenderness in the right lower quadrant of the abdomen.

CONCLUSIONS

1. Three cases are presented in which the vermiform appendix was found in the inguinal hernial sac at operation.
2. All three cases showed adhesions between the appendix and the hernial wall.
3. The appendix was removed without subsequent postoperative complications and the hospital stay of these patients was not prolonged.
4. Caution when opening the sac at operation is re-emphasized.

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BACTERIAL PROPERTIES OF "FREE" CHLORINE

The time of exposure of bacteria to free chlorine is a primary factor governing the extent of the bacterial kill; hydrogen-ion concentration has a marked effect on the bactericidal efficiency of free chlorine, the killing power diminishing with increasing pH values; increase in temperature tends to increase the bactericidal properties of free chlorine. When the effect of a lowered temperature is superimposed on a high pH, the reduction in the bactericidal efficiency of free chlorine is very marked.—Butterfield, C. T.; Wattie, E.; Megregian, S.; and Chambers, C. W.: Influence of pH and temperature on the survival of coliforms and enteric pathogens when exposed to free chlorine. Pub. Health Rep. **58**: 1837–1866, 17 December 1943.

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CERVICAL SPINE INJURIES

TREATMENT BY THE USE OF CRUTCHFIELD TONGS

ABRAHAM KAPLAN
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and
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Lieutenant Commander (MC) U. S. N. R.

Efficient management of a fracture or fracture dislocation of the cervical spine depends upon a careful evaluation of the degree and seriousness of damage to the spinal cord. Mild injuries of the cervical spine may be accompanied by severe and irreparable damage to the spinal cord. More frequently damage to the cervical spine is severe, with surprisingly little disturbance of spinal cord function. It is well to remember, however, that although no impairment of function is apparent at the initial examination, slowly progressive pathologic changes may take place in the cord, and unless proper anatomic alinement of the spine is maintained for months after the injury, serious disability may follow. In short, the cervical cord and the cervical spine cannot be treated independently; they must be viewed as a functional unit.

Much of what eventually happens to a person with an injury to the cervical spine depends on how he is handled by the person who first comes in contact with him. It cannot be stressed too often that in the first-aid care of a person with an injury of the cervical spine the head should never be flexed. The good intentions of giving such an injured person a sip of water, and thereby flexing the head, has on many occasions increased the existing damage. Traction to the head, with the patient in the supine position, is the only safe method of transportation. Traction should be applied gently and continuously until the proper apparatus can be secured.

When the patient is brought to the ward or sickbay he should be placed gently into bed with his head to the foot of the bed. Only in this way can uniform manual traction of the cervical spine be maintained. X-ray views can be taken with portable equipment while traction is continued.

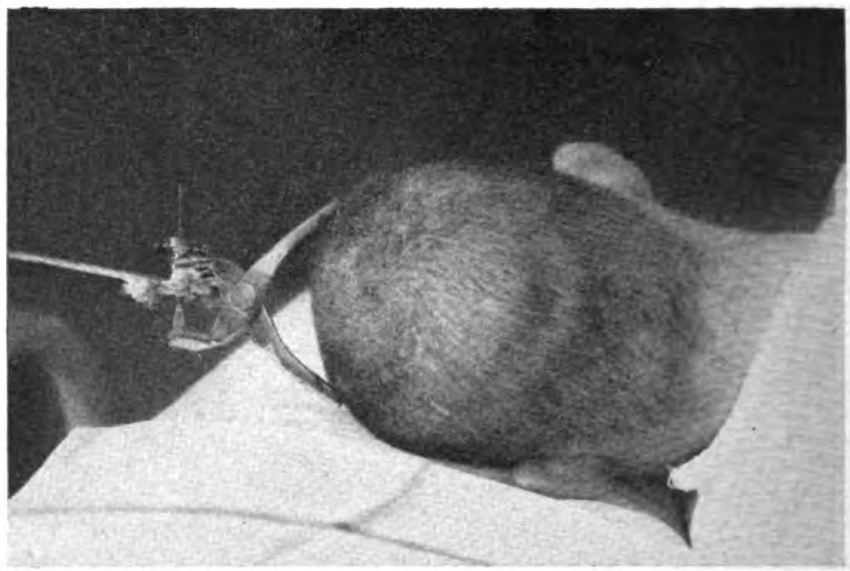
TREATMENT

After establishing the diagnosis, the scalp is shaved and the patient is wheeled to the operating room in bed. Utilizing local anesthesia,

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Crutchfield tongs are applied. The technic is simple; in brief it is as follows:

The tongs are applied to the vertex of the skull in a plane passing through the articulations of the cervical spine. The tips of the mastoids are approximately within this plane and serve as landmarks. The drill points measure 3 to 4 mm. to prevent excessive perforation. The tong points are at an angle which can be adjusted with a thumb screw. Application of gentian violet at the point of contact of the tongs with the scalp will prevent low-grade infection. In cases of scalp infection and thin skulls, Crutchfield tongs are contraindicated. For dislocations in the lower and middle third of the cervical spine 25 pounds of traction may be necessary; for dislocations in the upper third of the cervical spine 10 or 15 pounds of traction may be sufficient. After the fracture has been reduced the traction may be reduced to 6 or 10 pounds. The spine should be immobilized in a plaster cast as soon thereafter as possible.



1. Close-up view of the apparatus showing practically no reaction around the tong points.

This type of skeletal traction has been employed by Crutchfield in old as well as in recent fractures of the cervical spine with or without dislocation or spinal cord injury. In some of the cases of long-standing cervical spine injury he was able to obtain disimpaction and better cervical alinement by the application of 25 or more pounds of traction for short periods of time. In this manner he was also able to relieve pain by reducing the pressure on the sensory nerve roots at their points of exit, thereby eliminating the necessity for operative spine reduction and section of the sensory roots.

The chief advantages of this form of skeletal traction in fractures or fracture dislocations of the cervical spine are the simplicity with which the tongs can be applied, the greater comfort of the patient while under traction, and the facilitation of nursing care.

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During the swimming season there is usually an increase in the number of cervical spine injuries. Poor diving technic or diving into shallow water is the usual history of these injuries, particularly among Naval personnel who generally are strongly attracted to water sports. In the spring of 1942, within a period of 12 days, 4 patients were admitted to the hospital with cervical spine injuries sustained by diving into unexpectedly shallow water. One of them had a severe concussion of the spinal cord, while the others had incurred only minor damage to the spinal cord despite severe injury to the cervical spine. Three of the patients were treated with the Crutchfield tongs, but because there were no tongs for the fourth patient he was placed in a plaster cast. All the patients recovered fully.

CASE REPORTS

Case 1.—A 20-year-old service man was admitted to the hospital 7 hours after striking bottom as he dove through a wave in shallow water. There was no loss of consciousness but the patient immediately lost all power in both arms and both legs and felt a tingling sensation and numbness below the clavicles. He remained helpless in the water for about 20 minutes and was then washed ashore. This condition of paralysis lasted about one-half hour and then power and sensation began to return gradually, first in the legs and then in the arms, but the numbness in the right arm persisted for about 1½ hours. The patient was reported to have been in shock for several hours. He complained of pain across the back of the neck which was intensified by the slightest motion.

Examination disclosed tenderness over the fifth and sixth cervical vertebrae, weakness of the right grip, and exaggerated deep reflexes on the right. X-rays of the cervical region showed a crush fracture involving the anterior part of the body of the fifth cervical vertebra which was somewhat displaced backward. The intervertebral space between the bodies of the fourth and fifth cervical vertebrae was narrowed.

Crutchfield tongs were applied, using 10 pounds for traction, which was increased to 15 pounds within a few days. Traction was continued for almost a month and then a plaster cast was applied. The patient remained in the cast for 6 weeks and then requested transfer to a hospital nearer his home. At the time of transfer he was asymptomatic and exhibited no abnormal neurologic signs. He has since returned to duty.

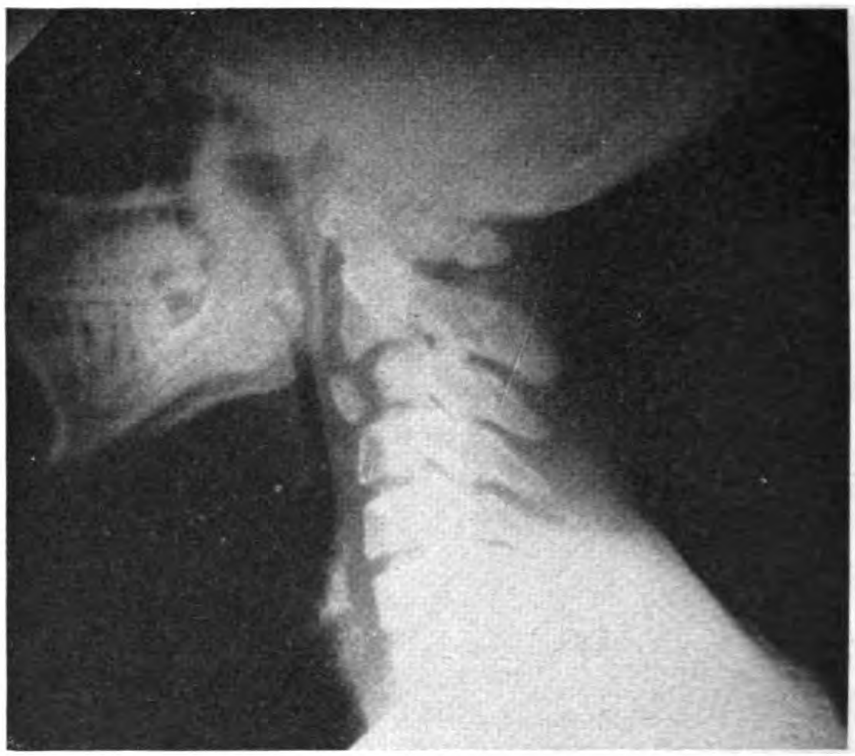
Case 2.—A storekeeper, second class, 27 years old, was admitted to the hospital complaining of pain and stiffness of the neck. On the previous day he dove into shallow water and the top of his head struck bottom. He experienced dizziness and both legs became weak. A few hours later he noted pain and stiffness of the neck.

Examination revealed nothing of note with the exception of some cervical spine tenderness. X-ray examination showed a fracture through the anterior portion of the body of the third cervical vertebra. The fractured fragment was displaced anteriorly and inferiorly with separation of about three-quarters of an inch. In addition there was a posterior dislocation of the body of the second cervical vertebra with encroachment upon the spinal canal. A fracture was also noted through the spinous process and lamina of the second cervical vertebra (fig. 2).

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Crutchfield tongs were applied, utilizing 15-pound traction. The tong screws were checked daily and tightened when necessary. Four days after their application the patient slipped off the side of the bed and was found on his abdomen with elbows and hands holding onto the edge of the bed. The tongs held securely and he was returned to his bed without further incident. Three weeks later the tongs were removed and a plaster cast was applied and maintained in position for 3 months. There were no subjective complaints and no abnormal neurologic signs could be demonstrated. Check x-rays of the cervical region showed good bone alinement with moderate callus formation, and the patient was discharged to duty.

Case 3.—A storekeeper, second class, 25 years old, was admitted to the hospital stating that on the day previous while diving from a pier, the left side of his



2. (Case 2.) Fracture and dislocation of the second and third cervical vertebrae.

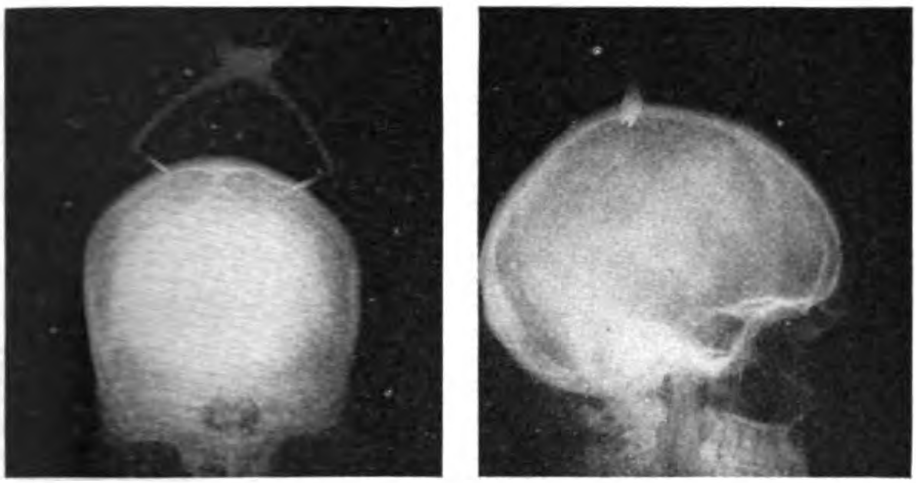
head and left shoulder had struck bottom. This was immediately followed by loss of power and sensation in the left arm and numbness over the entire left side of the body. Within several hours, however, sensation began to return, followed by slow but definite improvement in the function of the left arm. He had also noted some pain across the left side of the chest associated with dyspnea.

Examination revealed only a superficial abrasion over the anterior of the vertex, a tilting of the head to the right, acute tenderness to the left of the third and fifth cervical vertebrae and diminished biceps, triceps and patellar reflexes on the left.

X-ray examination of the cervical spine showed a comminuted fracture involving the lateral third of the body of the fourth cervical vertebra on the left. The fracture extended through the pedicle and into the transverse process with displacement of the lateral mass to the left. There were also fractures through

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the fifth and sixth cervical vertebrae with slight deformity. In addition there was very suggestive evidence of a fracture of the body of the third cervical vertebra. X-ray examination of the chest showed a partial atelectasis. Crutchfield tongs were applied using 20 pounds of weight. Power returned gradually in the



3. (Case 3.) X-rays of the skull showing position of tongs. No osseous reaction occurred although the tongs were maintained in position for over 2 weeks.

left arm and all the reflexes became normal. X-rays of the skull with the tongs in place taken 2 weeks after their application showed no reaction around the points of insertion into the bone (fig. 3).

Check films of the cervical vertebrae showed good alinement, and after 3 weeks the tongs were removed and the patient was put into a plaster cast in which he remained for 3 months. Shortly thereafter he was returned to full duty.

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MEDICAL TREATMENT OF PILONIDAL CYST

A series of four patients presented themselves to sickbay with infected pilonidal cysts. A hemostat was inserted (without anesthesia) through the dimpled opening in the midline into the cyst cavity and spread gently. Each opening extruded a varying quantity of pus (from 2 to 10 cc.). A thin metallic applicator with cotton dipped in a solution of phenol and oil of cloves, equal parts, was left for a few minutes in the depth of the cyst, followed by an alcohol swab. This swabbing process was repeated on one or two succeeding days and no other treatment was used. Thus far (2 to 4 months) there have been no recurrences, and no time has been lost from duty. It is interesting to note that some 15 years ago the writer used a similar treatment on two other cases effecting what seems to be a permanent cure. In all cases the patients were symptom free and quite oblivious of the presence of the scarified cyst.—Glauser, Frank, Lieutenant Commander (MC) U. S. N. R.

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ACTINIC RAY OPHTHALMIA

A METHOD OF TREATMENT

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and
CHARLES K. MILLER
Lieutenant Commander (MC) U. S. N. R.

It is the purpose of this article to set forth a method of treatment which may be helpful in decreasing lost-time accidents due to actinic ray ophthalmia.

During the past 14 months at one of our larger navy yards, over 3,000 such cases were treated by a number of different methods with little or no change in the percentage of lost time.

A plan of treatment was formulated as a result of observations made at other industrial plants, which in comparison with older methods of treatment has produced rather spectacular results.

The treatment used in the first group consisted of the instillation into the eyes of holocaine and epinephrine ointment, which is made in the following proportions.

Holocaine, 4 grains to the ounce.
Epinephrine (1:3,000), 20 minims to the ounce.
Lanolin and white petrolatum adjusted to the proper pH for ophthalmic use.

Secondly, 20 minutes of infra-red exposure was given at approximately 24 inches, with the subject looking directly into the lamp.

This first group consisted of 110 cases, all of whom gave the usual history of welding or being exposed to the welding arc, and presented the usual signs of actinic ray ophthalmia. All of this series returned to work immediately following treatment, and none required any further treatment.

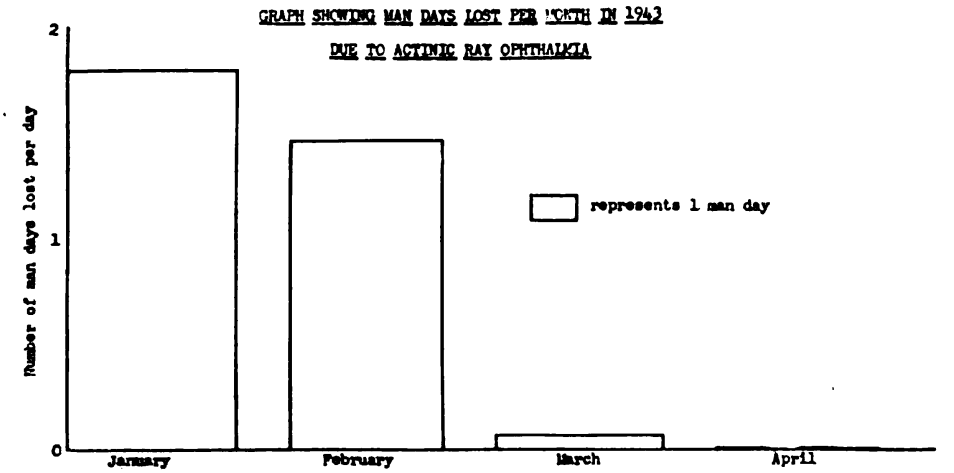
In the second group of 95 cases boric acid solution was substituted for the holocaine and epinephrine ointment. Infra-red treatment was given as in the first group. We were surprised to find that there were no lost-time accidents and all returned to work. No further treatments were necessary in this group.

The final series consisted of 50 cases in which holocaine and epinephrine ointment only was used, and no infra-red. In this group 5 patients came back for further treatment after attempting to work. These cases were given infra-red treatment after which all were able to resume work.

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The interesting fact remains that since the institution of this treatment over 500 cases have been handled with no lost-time accidents.

During the month of January, 25 "flash" cases lost 56 days; in February, 16 lost 41 days; and in the first 3 days of March, before treatment was begun 2 cases lost 2 days. Since that time, for over a period of 2 months all actinic ray ophthalmia patients have been able to return to their jobs immediately following treatment. The following graph is significant.



NOTE: Number of workers exposed to actinic ray is constant or slightly increasing.

While the mode of action is not clearly understood, no unusual effects have been observed following treatment with infra-red. For a short period following exposure the conjunctival injection is increased, but this diminishes rapidly and in several hours has almost completely disappeared.

Our conclusion as to the best treatment for this type of case is as follows:

1. Most cases, after a period of 10 minutes following the instillation of holocaine and epinephrine ointment, are given a second instillation of the ointment and returned to work.

2. The cases of a more serious nature who after a period of 10 minutes following the instillation of holocaine and epinephrine ointment still complain of pain or photophobia, are given 20 minutes of infra-red treatment and returned to work.

It is hoped that by this method practically all lost time from the common condition of "welder's flash" will be stamped out.

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THE HEALING OF SURGICAL WOUNDS IN THE TROPICS

There seems to be a widespread belief among surgeons that operative incisions and wounds do not heal as rapidly or as well in the tropics as they do in a more temperate climate.

The fact that both the patient and the operator perspire more freely makes the probability of contamination more likely. This can be obviated, to a large extent, if air conditioned operating rooms are available, or if the operating teams wear towels and cloths around forehead and neck.

The wounds likewise can be protected by the use of towels or gauze along the edges of the incision. These should be placed on the incision as soon after it is made as possible.

Insects also may cause considerable annoyance. In spite of screening and blackout panels the smaller insects may be present in the operating room. That was particularly true at certain times of the month, when the small copra bugs would be very troublesome. In spite of all that could be done they would occasionally get into wounds or on our dressings or instruments. This condition was always worse at night. These wounds were flushed with normal saline solution just before closure.

The operative field would be prepared the day before operation, except in emergencies, in the usual manner. In orthopedic cases a 48-hour preparation was done; i. e., the areas were shaved, washed with soap, water and alcohol two nights before operation, and the same preparation repeated the evening before operation, with the areas kept wrapped in sterile bandages. At the time of operation the field was prepared with three applications of tincture of merthiolate. Catgut was usually used for the closure of the wounds. We have found that the finer catgut is more satisfactory for wound closures and ties. At times it was necessary to use heavier catgut because the finer was not immediately available, and when this was necessary serum would accumulate occasionally in the wounds. We used absorbable sutures as a rule but in neighboring hospitals cotton was used with good results. The skin was closed with interrupted sutures of fine silk or dermal.

In spite of the above unfavorable circumstances we had no serious wound infections. Nearly all of the wounds healed by first intention, without serum accumulation or signs of irritation. There were one or two superficial stitch infections but no wound had to be reopened and no deep sutures were removed. All clean wounds healed without unusual reaction, except a few where small amounts of serum would accumulate. All of these were cases where the heavier catgut was used. No orthopedic case became infected, although we did many arthrotomies, especially of the knee. There were no infections in the open reductions done for simple fractures, or where internal fixation was used.—Frederick R. Robbins, Commander (MC) U. S. N. R.

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MEDICAL AND SURGICAL DEVICES

SUGGESTIONS ON THE USE OF THE EQUIPMENT OF THE STANDARD ARMY-NAVY PACKAGE OF DRIED PLASMA FOR WHOLE BLOOD TRANSFUSIONS

LLOYD R. NEWHOUSER
Captain (MC) U. S. N.
and
EUGENE L. LOZNER
Lieutenant (MC) U. S. N. R.

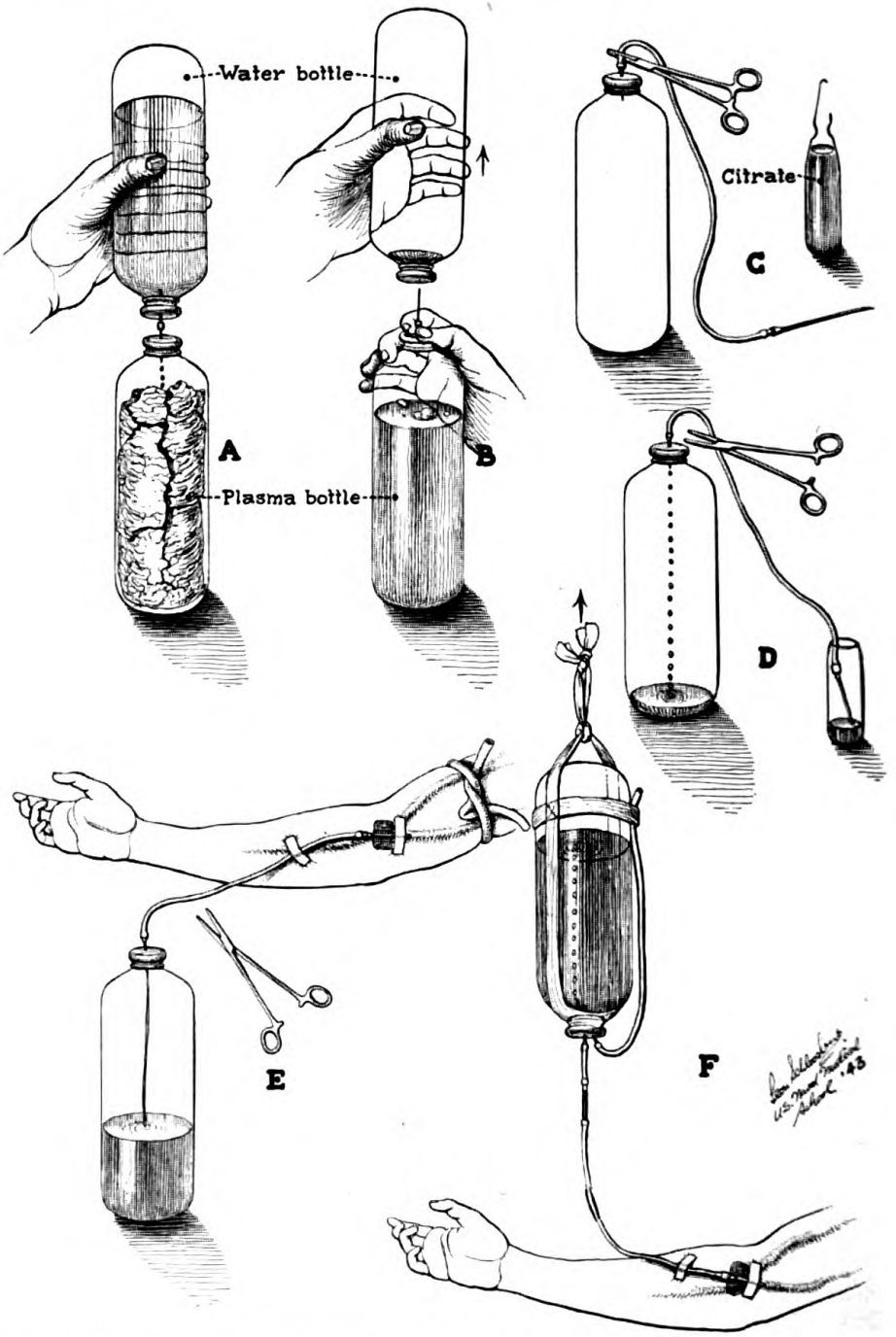
It has been pointed out repeatedly that the timely use of whole blood transfusions may alter significantly the prognosis of a wounded individual and may shorten considerably his convalescence. Fortunately, with the possible exception of carbon monoxide poisoning, very few emergency situations exist in which plasma is not at least the peer of whole blood. It not infrequently occurs, therefore, and quite understandably, that the Standard Army-Navy Package of Dried Plasma is supplied to certain installations in preference to or in amounts greater than equipment for whole blood transfusion. Technics have now been worked out whereby the equipment of the dried plasma package can be used to draw and administer whole blood in any situation where pyrogen-free sodium citrate and the facilities for sterilizing rubber tubing and needles are available. It is possible by using appropriate measures to perform such a transfusion by the "closed-vacuum" system, the "closed-nonvacuum" system, or an "open system." The choice is left to the operator. Directions for all three systems follow, accompanied by illustrations.

The "closed-vacuum" system (fig. 1 A–F).—The use of this system is dependent upon the omission of the airway for the water bottle in reconstituting the dried plasma. Sufficient vacuum exists in the plasma bottle to draw in the water without an airway, and in so doing a vacuum will be created in the water bottle. Details follow:

1. After removing the contents of the cans and cleaning the stoppers of the bottles with an antiseptic, puncture the stopper of the water bottle with one end of the double-ended needle.

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2. Invert the water bottle over the plasma bottle and run the other end of the needle through the stopper of the plasma bottle (fig. 1 A).

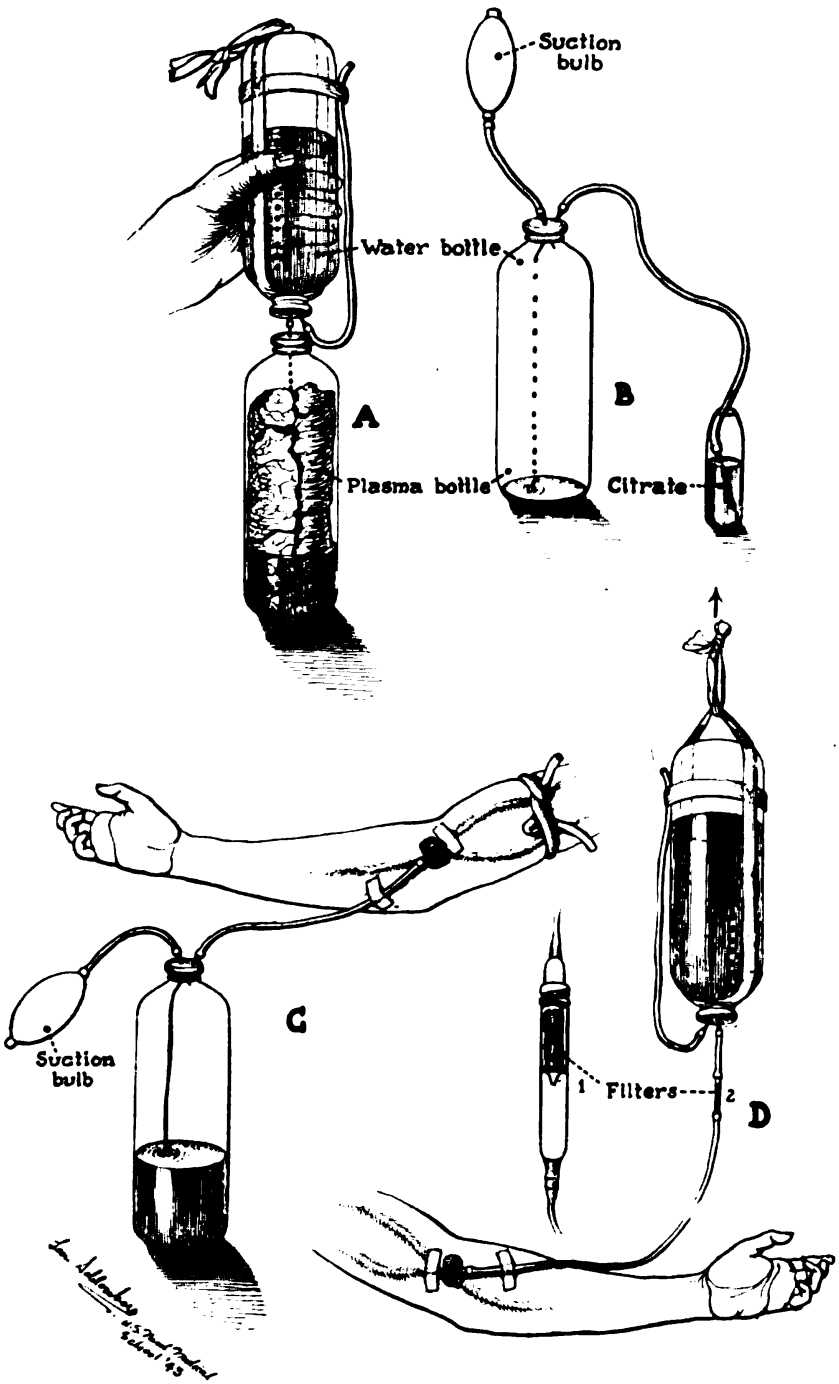


1. This shows the equipment used to administer whole blood by *closed-vacuum* system.

3. Allow water to run into plasma bottle, stopping while there still remains enough water in the neck of the water bottle to cover the end of the needle.

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4. When this point is reached, holding the needle in the plasma bottle, quickly raise the water bottle, disengaging it from the double-



. This shows the equipment used to administer whole blood by *closed-nonvacuum* system.

nded needle. Then remove the needle from the plasma bottle (fig. B).

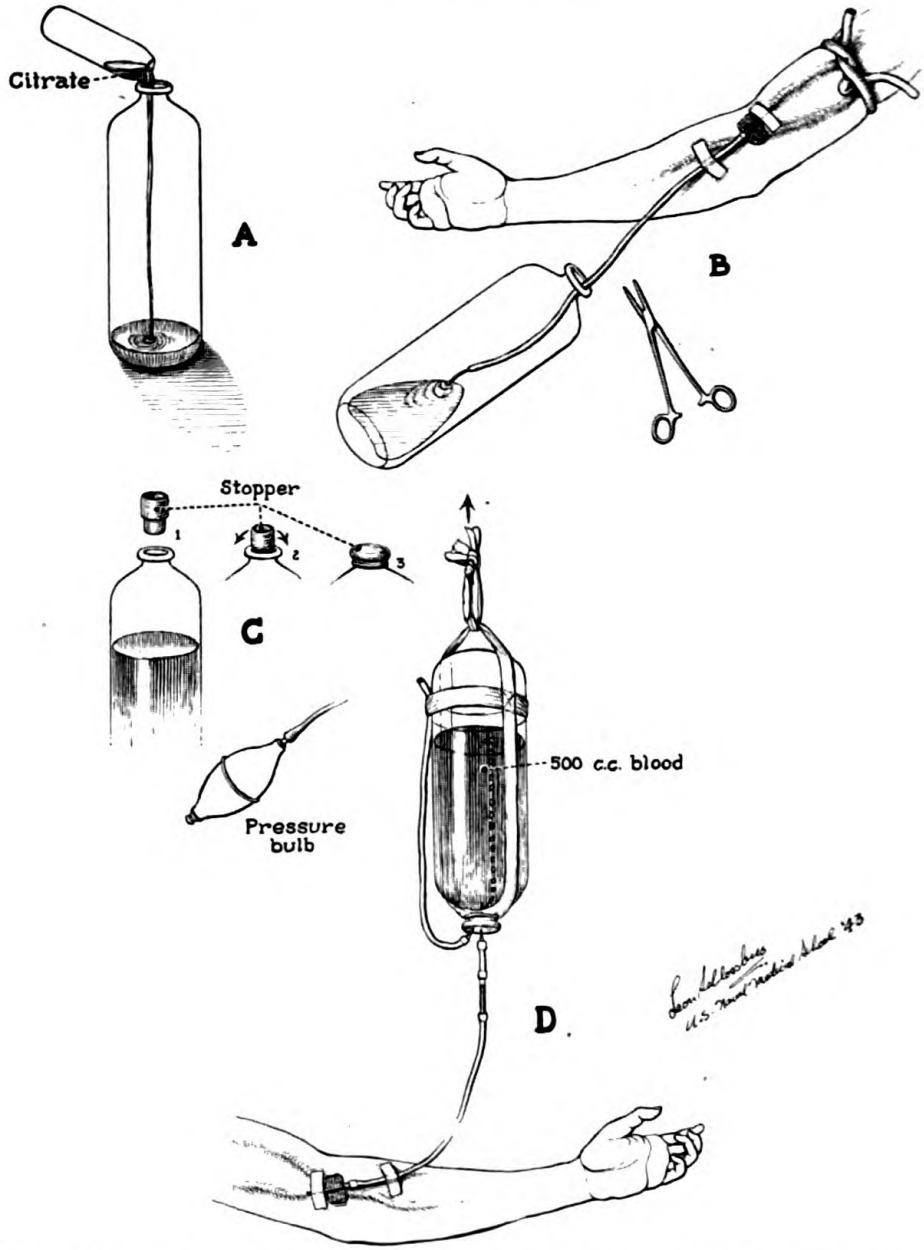
5. The plasma bottle after the plasma goes into solution is ready or administration by the standard technic.

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6. The water bottle now contains a vacuum and has remained sterile.

7. Assemble and sterilize a donor set consisting of a needle on both ends of a short length of rubber tubing and a clamp. It is recommended that 15-gage hose hub needles be used.



3. This shows the equipment used to administer whole blood by *open* system.

8. Open a glass-sealed vial of sodium citrate solution. Clamp off the rubber tubing in the donor set and insert one needle into the water bottle (fig. 1 C). Then insert the other needle into the vial of sodium citrate and release the clamp (fig. 1 D). Allow the citrate to flow

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into the water bottle keeping the needle in the citrate vial covered with solution at all times, until only a small amount remains to cover the needle. Then quickly clamp off the rubber tubing.

9. With the rubber tubing clamped off, remove the needle from the citrate vial and insert it into the donor's vein. Release the clamp and blood will be drawn into the bottle by vacuum (fig. 1 E). If vacuum is lost by accident, proceed according to "closed-nonvacuum" system following.

10. Administer the blood exactly the same as plasma; incorporating however, an appropriate filter in the intravenous set (fig. 1 F).

The "closed-nonvacuum" system (fig. 2 A–D.)—This is exactly the same as the "closed-vacuum" system except that in the restoration of the plasma or in subsequent procedures, the vacuum in the water bottle has been released (fig. 2 A). An airway must therefore be provided for the exit of air during the introduction of sodium citrate and the drawing of the blood. The airway which is supplied with the plasma set is entirely adequate for this purpose. A syringe may be used to introduce the sodium citrate or the method described under the "closed-vacuum" system plus the application of bulb-suction to the airway (fig. 2 B). The blood may be drawn by gravity or by the application of bulb-suction to the airway (fig. 2 C). Administration is as previously described (fig. 2 D).

The "open" system (fig. 3A–D).—In this system the stopper is removed from the water bottle after completion of the reconstitution of the dried plasma, and sodium citrate solution is poured in (fig. 3 A). The donor set consists simply of a needle and a short length of rubber tubing. The needle is inserted into the donor's vein and the rubber tubing into the neck of the water bottle (fig. 3 B). For administration, the stopper is reinserted into the bottle (fig. 3 C) and the same intravenous set as for plasma plus an adequate filter used (fig. 3 D).

Sodium Citrate Solution.—Ten cubic centimeters of 2½ percent sodium citrate solution are required to prevent the coagulation of each 90 cc. of blood drawn. Thus, for the old style package, where the water bottle now contains 300 cc. of water, 40 cc. of 2½ percent sodium citrate solution would be required, inasmuch as the total capacity of the bottle is 400 cc. For the new style large size package, the production of which has just recently started (September 1943), 75 cc. of 2½ percent sodium citrate are required, as the capacity of the bottle is 750 cc. Sodium citrate is available in the Supply Catalog in 50-cc. ampules of a 2½ percent solution (Stock No. 1–775). Dry sodium citrate crystals cannot be assumed to be nonpyrogenic and should not be used unless they can be guaranteed as such and unless pyrogen-free water is available to make up the solution. It is imperative that clots

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be prevented in the citrated blood by using sufficient or even an excess of sodium citrate and by constant gentle agitation during collection of the blood, as any clots which might form will clog the 15-gage connecting needle used in the intravenous set.

Filters (fig. 2 D).—The new standard Army-Navy package of dried plasma (750 cc. bottle) is supplied with a stainless steel filter which can be used as a filter for administering 500 cc. of fresh whole blood. It was originally intended that these filters be discarded after use. When they are to be used for blood transfusions, the filter should be thoroughly cleaned in sulfuric acid and then flushed well with freshly distilled water and assembled for sterilizing. The filtering surface may be increased somewhat by reversing the position of the filter as it comes in the plasma package. The glass tape filter used in the old standard Army-Navy package of dried plasma is not suitable as a filter for whole blood. Other filters for whole blood are available commercially, most of which are satisfactory.

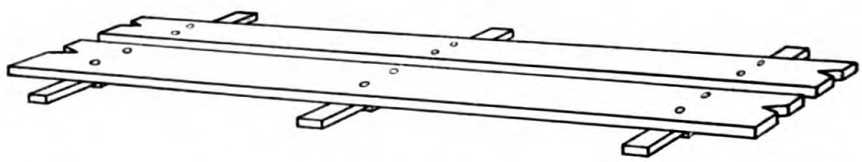
DESCRIPTION OF AN ALL-PURPOSE RIGID LITTER-SPLINT

EDWARD W. PANGBURN
Lieutenant Commander (MC) U. S. N. R.

This all-purpose rigid litter-splint is a simplified item of medical field equipment designed to facilitate the handling and transportation of certain types of battle casualties on the principle of complete immobilization of the patient. This complete immobility of

RIGID LITTER SPLINT

Perspective View From Above



the injured man can be effected under all conditions and the patient transported in any position. It is particularly applicable when injury occurs under conditions where space is limited or the handling of

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RIGID LITTER SPLINT

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the patient must be carried out under unusual and difficult situations, as through narrow passageways.

By the use of this litter-splint and simple bandages, it is possible completely to immobilize the patient and to move him in a normal, recumbent position, on his side, perpendicular, or any combination of these positions without danger of further injury or shock. While on the litter-splint, the patient can be examined, x-rayed and given stimulants by mouth or parenteral injection. To an extent not possible with other types of litters or stretchers, he can be moved through narrow doorways or passageways, taken up and down ladders, through hatches, along a route involving twists and turns, or can be raised or lowered by hoists.

Construction.—The litter-splint itself is of very simple construction. It consists of 2 longitudinal hardwood boards, 6 feet 6 inches long, 6 inches wide, 1 inch thick and notched at each end. These are spaced exactly 2 inches apart and bolted to crosspieces which also serve as handles.. The crosspieces are made of 1-inch stock, 22 inches long and 3½ inches wide. Wood block legs, 1 inch high are attached under the crosspieces. One crosspiece goes at the center; the others, 9½ inches from the ends. The two bolts in each crosspiece are staggered for rigidity. No special materials are needed for construction.

The longitudinal boards are notched so that bandages may be secured from either end for the application of pressure on the patient. In this manner, extension can be applied to his legs in case of fracture of the femur, or to his neck in case of fracture of the cervical vertebrae.

An essential part of the construction is the 2-inch space between the longitudinal boards. These are bevelled along the inside edges to form a trough wide enough to fit the spine of the patient. The 2-inch space between the planks is provided in order that the spine may be free from pressure when the patient is placed on the litter-splint.

Eighteen triangular bandages, 50 inches long, should be available for use with each litter-splint.

Use of the litter-splint with patient supine.—In case of fracture of the cervical vertebrae or injury to the spinal cord in this region, the following procedure is advised: In using this litter-splint, the patient is lifted carefully, avoiding any torsion of the spine, and gently placed on the litter-splint with his spine resting in the space between the two planks. A thin pad is placed under his occiput. He is then securely tied to the plank with just one thought in mind—complete immobilization of his body on the splint. His head and trunk are fastened by turns completely around both planks. Securely tied in this manner, the patient is ready to be moved or can be left reasonably comfortable for subsequent moving without danger of further injury.

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Bandages should be placed crisscross over the chest and under the axillae, as likewise across the upper abdomen over each iliac. The head is secured to the board by means of a bandage over the forehead and under the chin. The arms are crossed over the chest and tied at each wrist. Bandages are firmly applied to each upper and lower thigh and also above and below the knee. Each ankle is tied.

Use of the litter-splint with the patient prone.—In cases of injury to the spine involving the lower thoracic, lumbar, or sacral segments, it is certainly advisable to place the patient on his abdomen. His shoulder should be in line with the first crosspiece of the splint, his head turned to either side, his arms placed at his sides, not under his head.

It is well to place a firm pad of gauze, or any material available such as a shirt, a towel, or a jacket between the tops of his shoes and the ankle joint. This will give support and comfort to his lower limbs.

With the patient in the prone position the bandages should be placed with the necessary modifications to conform to anatomic relations.

Method of placing ties.—In order that this procedure be carried out successfully it is absolutely essential that the bandages be put in the proper places with equalization of pressure and correct location of knots. It is advisable to use triangular bandages 50 inches in length, folded to a 3-inch width. They are found most satisfactory because they remain straight, do not roll or cut the tissues, add protection to the tissue and do not obstruct circulation. All ties must be square knots placed on the same side so as not to create undue pressure or interfere with the proper handling of the patient. Ties should not be placed on top or bottom.

The cardinal principle involved is that of fixation, producing complete immobility of the patient. Additional time may be consumed in such detailed fixation. That investment of time however may be the key factor in preventing secondary shock.

Under battle conditions in the field, this type of patient may have to be given secondary consideration. He would be infinitely better off if the litter-splint were quickly applied and he be left in that position for several hours without medical attention rather than to permit him to suffer and die as a result of continued or secondary shock or self-induced injuries made by muscular movements while in an irrational state of mind. It may be observed that this litter-splint may be used for the restraint of irrational patients who must be moved from the scene of their injuries.

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CELLULOID SPLINT IN TRAUMATIC AMPUTATION OF DISTAL PHALANGES

JOHN B. O'TOOLE, JR.
Lieutenant Commander (MC) U. S. N. R.

Originality for this method of treatment of partial traumatic amputations of distal phalanges is disclaimed. However some modifications have been made by the author which are believed to be improvements.

The principle of the therapy is based upon the observation that narrow strips of adhesive tape applied to lesions such as varicose ulcers or extensive burns result in the appearance of pink granulations along the edges of the adhesive within a few days. This same principle is utilized in the celluloid splint.

METHOD OF APPLICATION

The patient is given a Syrette of morphine. The finger is then anesthetized by blocking with procaine and the traumatized area is debrided of all devitalized tissue. Minute care is taken to attain hemostasis. A piece of celluloid obtained from a used x-ray film is cut 2 cm. longer and 1.5 cm. wider than the circumference of the injured finger. It is sterilized by immersing in alcohol after which it is applied by winding it around the affected member and securing in position by two turns of a braided silk suture material. It is important that the film fits snugly to the head of the metacarpal and is tied. The film adapts itself readily to the contour of the finger. The adaption of the film to the amputation stump is more difficult to accomplish but unless this be precisely attained, the whole purpose of the splint will be lost. A snug fit can be obtained by slipping a mosquito forceps inside the tube and grasping the inner edge of the film. A clockwise movement will draw the film tightly to the finger. While in this position an assistant secures it with another piece of braided silk.

The amputation stump is now dusted with sulfanilamide powder by introducing an insufflator inside the end of the tube. Gauze strips (one-half inch), which have been impregnated with balsam of Peru or scarlet red ointment, are now packed into the tube so that they completely cover the amputation stump. The remainder of the tube is then filled with a loose gauze pack.

The film splint is left in place 8 to 10 days, but daily dressings are done through the opened end of the tube. The first dressing can be made practically painless by applying hydrogen peroxide before disturbing the dressing. This not only loosens the gauze strip but also

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dissolves any dried blood which has accumulated at the end of the stump. The stump is very gently wiped, sprayed with sulfanilamide powder and the balsam dressing reapplied. In a few days pink granulations will be seen building up from the stump along the periphery of the tube.

The film is replaced in 10 days by cutting the sutures and filling the tube with hydrogen peroxide to loosen it from the stump.

These granulations will keep building up along the tube until almost the whole amputation tip has been replaced by fresh granulation. Of course there will be no regeneration of bone, but the finger (lacking bone at the tip) will become almost completely replaced. If some of the matrix cells remain, a new nail will regenerate affording added protection to the end of the regenerated finger.

I have seen many of these cases and have had most gratifying results by using this form of treatment. An important asset for its recommendation is the ease with which dressings can be applied with almost complete absence of pain. This is indeed an advantage over the former method of removing the entire dressing every time the wound is redressed—a very painful, and destructive procedure sacrificing each time some healthy granulating tissue.

THE NAVY DENTIST AND THE PORTABLE FIELD DENTAL UNIT NO. 35

RAYMOND L. CULLEN
Lieutenant (DC) U. S. N.

Suggestions pertaining to the procurement of accessory equipment is not meant to reflect criticism on the present armamentarium of the portable unit. It is rather to reveal that a more favorable situation confronts the dentist in the present conflict than that for which the equipment was originally designed. This article is based on experiences, encountered on two occasions while on active duty in the Pacific theater of the war.

It is exceedingly important for the officer and corpsman to make a detailed survey of the field equipment as soon as it is issued. In this manner the distribution of the material is ascertained, and the opportunity is afforded to supplement the unit with desired accessories. Every dentist has certain articles of equipment which he favors and without which his whole technic of operating is disturbed. These articles may be very minor and relatively insignificant, but they afford much satisfaction to the officer as the months pass. Once in the field it is exceedingly difficult to obtain additional equipment.

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The following pieces of equipment have been found desirable for use with the portable unit:

1. An electric hot plate—for use with the sterilizer when electricity is available.
2. Amalgam alloy—mercury-measuring dispenser.
3. Syringe jar.
4. Cow horn forceps.
5. Howe's ammoniacal silver nitrate solution.
6. Cartridge syringes with a sufficient supply of cartridges (these can be refilled when necessary).
7. Set of small bottles for cavity sterilization liquids (empty bottles are very scarce in the field during the first few months).
8. Canvas instrument cases with individual pockets for all surgical instruments. These protect the instruments from moisture, make them immediately available and well arranged. It is not assumed that the instruments are kept sterile in these cases; they must be heat sterilized before use.
9. Quartz mortar and pestle.

In the No. 2 field kit the following supplies were supplemented:

1. Morphine Syrettes.
2. Box of triple distilled water (10-cc. tubes).
3. Fifty novocain cartridges for use with either a cartridge or Luer syringe.
4. Small box of acetylsalicylic acid.
5. Zinc oxide.
6. Eugenol.

Some of these supplies are included in the regular dental supply list, but not in the field units. Others may be obtained from the medical department. However, this should be checked before the equipment is packed. A few articles will have to be obtained through open or private purchase as the situation dictates.

Every attempt should be made to obtain an electrical dental engine to supplement the foot engine. In the field the foot engine is not justified in the vast majority of cases, as electricity is almost universally available under modern warfare conditions. True, during the first few days of establishing a camp or the days immediately following a period of combat, current may not be available. At these times the patients are too busy performing vital tasks to have any dental work done except that of an emergency nature. These can be taken care of by using the number 2 field unit.

Without exception, in every office visited in the Southwest Pacific in which the foot engine was standard equipment, attempts had been made with varying degrees of success to convert the unit to an electrically driven device. Malted milk mixers, photo-laboratory motors, and other small types were being used with simple button switches to control the current. Very seldom was it possible to construct a rheostat.

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The number 2 portable field engine is quite satisfactory wherever it is in use; its weight and bulkiness, however, compromise its value as a field unit. It is suggested that a small electrical dental engine which fits into the left edge of the operating cabinet be secured for future portable dental outfits. Such engines are available and are in use in many dental colleges throughout the country.

The necessity for including a limited supply of prosthetic equipment in the portable dental outfits is becoming increasingly apparent. Broken dentures and fractured porcelain teeth are the most common accidents which befall the individual. It must be recognized that such unfortunate individuals cannot always be released from duty to make an extended trip to an area where prosthetic service is available.

The inclusion of a reasonable supply of stone, wax, tinfoil, resin, teeth, trays, two flasks, and some compound would make simple denture repairs possible. Work of a major nature would not be attempted. No vulcanizer would be necessary, as boiling water could be used to cure the resin.

IMPROVISED SALIVA EJECTOR

JOHN E. CARSON
Lieutenant (DC) U. S. N. R.

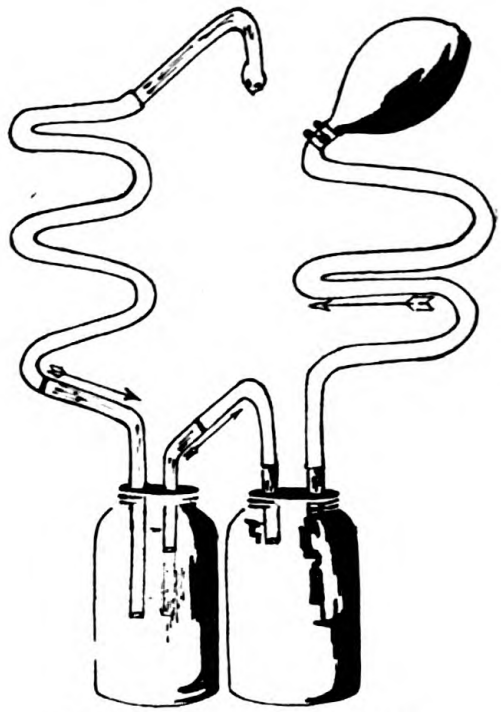
In field dentistry the problem of saliva ejection is one of great concern.

The simple apparatus illustrated can be quickly set up for use by any dental officer in the field. The apparatus consists of:

1. Two empty jars (plasma or dextrose).
2. Mouthpiece. This may be made by bending one-quarter-inch glass tubing to the required shape and sealing the end that is to be placed into the mouth. Immediately following the sealing of the end, blow into the tube to form a bulb expansion of the sealed end. While the glass is still glowing, puncture holes on 4 sides with the aid of a small, round, red-hot instrument, approximately 2 mm. from the closed end.
3. Rubber bulb; the exhaust type (negative bulb).
4. Two adequate lengths of rubber tubing from mouthpiece to first jar and from second jar to exhaustion bulb.
5. Rubber or glass tubing connecting jars. Tube entering the first jar should extend a few inches below the corresponding outlet tube to prevent bubbles of saliva passing into the second jar.

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The use of this apparatus has shortened oral procedures which require a dry field. Another advantage noted is the psychologic effect on the patient. He is occupied in slowly manipulating the bulb in order to obtain proper vacuum.



1. Improvised saliva ejector.

The two-jar apparatus is preferred to a single jar for the following reasons:

1. Less frequent manipulations of the bulb are required.
2. Larger vacuum space is obtained.
3. Saliva flow is more continuous.
4. Exhaust bulb remains dry. If attached to one jar alone, vaporized moisture condenses in the exhaust bulb and attached tubing.

Acknowledgment is hereby given to Lieutenant Commander Richard B. Schutz, (MC) U. S. N. R., for assistance and suggestions and to Sergeant G. J. Chambers, U. S. M. C. R., for preparation of the sketch.

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EMERGENCY REPAIRS OF PROSTHETIC APPLIANCES

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Commander (DC) U. S. N.
and
CHARLES D. HEMPHILL
Lieutenant Commander (DC) U. S. N.

This article deals with the emergency repair of denture plastics when there is no prosthetic activity available. The preferred treatment is to send the patient to the nearest station which is equipped for this type of work; many times this is impractical, however. The patient therefore may be deprived of his denture for a long period of time. This may cause only a slight annoyance, or may result in complete loss of proper mastication.

With this condition in mind, a simple method of repairing broken acrylic dentures, porcelain teeth, porcelain crowns and acrylic crowns is presented. This technic can be used either for a fractured denture with all fragments present or where a portion of the fractured denture has been lost. Broken crowns, facings and porcelain teeth may be repaired and replaced if all or nearly all fragments are available.

Materials and equipment required.—All of these repairs can be made by using the standard equipment found in Naval medical and dental offices. No special supplies are needed other than a 1-unit package of acrylic resin in both the powder and liquid form. This can be obtained at any dental supply house. Sticky wax, baseplate wax, and plaster of paris, the other materials required, are usually found in all Naval dental offices. The equipment used is the sterilizer of the dental office or the incubator of the medical laboratory.

Preparation of acrylic sirup.—The regular unit of dental acrylic is used to prepare a thickened monomer sirup. The liquid (monomer) and powder (polymer) acrylic resins are used in proportions of 5 parts of monomer to 1 part of polymer. The monomer is placed in a closed ointment jar, put in a cold water bath and heated to the boiling point. The jar is then removed and the polymer is added to the hot monomer. The mixture is thoroughly spatulated. Approximately 5 minutes of constant stirring are required to complete the mix, as the polymer will tend to lump when added to the hot monomer. The resultant mix will be a sirup-like mass. It is preferable to keep the jar in a cold place. The consistency will be maintained for many weeks if the jar is kept tightly closed. Should the mix thicken it may be thinned by stirring more monomer into it.

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Preparation of broken denture.—The fragments of the denture are cleaned, fitted together and held by sticky wax. All the undercuts are relieved by filling them with wet paper, wet cotton or softened baseplate wax. The denture is lubricated with liquid soap or oil. A plaster cast is then poured and allowed to set. The cast should be at least 1 inch thick. The denture is removed from it, cleaned with green soap and dried with alcohol and air. The fractured edges of the denture are painted with pure monomer and then with an excess of the above described sirup. The fragments are fitted together on the model and the case is ready to be cured in one of the following ways:

1. The laboratory incubator may be set at 170° F. and the assembled denture and cast placed therein for 1½ hours to cure in dry heat.

2. The model may be immersed in one-half inch of boiling water in the sterilizer for 1½ hours to cure in moist heat. With the cast partially immersed in water and the denture entirely above the water the low thermal conductivity of the plaster allows the repair to cure at the desired 170° to 175° F.

Miscellaneous repairs.—Fractured porcelain teeth and crowns may also be mended by using the acrylic sirup. In such cases, and in fractured dentures which may be fitted togther and will stay in place without assemblage on a cast, the model is unnecessary if the dry heat method is used. The pieces are merely painted with the sirup, assembled and cured in the incubator. Broken porcelain teeth and crowns may actually be fastened together by this sirup. At times a portion of the fractured denture is lost. When this occurs the missing part is molded in place with softened wax or compound and a model is made. The standard dental mix of 3 parts polymer to 1 part monomer is used in conjunction with the sirup. All broken surfaces are painted with the sirup and the regular acrylic resin is then molded to the model with finger pressure and cured. If a new tooth is being used to replace a missing one, enough adjacent material is cut away to aline the tooth properly. The denture is painted with sirup and packed with the standard dental acrylic mix and the tooth forced into place. The case is then cured. The finished repair will present a much better gingival fit than by the usual "hot pin" method. All repaired areas are polished with stones and disks.

Correction of case.—All fractures of individual teeth, crowns and dentures may be placed into three classes:

1. Fractures due to accidents, i. e., droppage, blows, etc.

2. Fractures due to faulty occlusal relations, i. e., high tooth or cusp.

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3. Fractures due to unequal resorption of supporting tissues which causes torsional strain during mastication.

The expectant success of class 1 repairs is excellent.

In repairs of classes 2 and 3 the cause must be removed to prevent recurrence of the fracture. For correction of class 2 cases the occlusion is checked thoroughly with articulating paper. All high spots are relieved and this correction process continued until the entire denture bears evenly on the opposing dentition. With the occlusion corrected the expectant success of the repair is again excellent.

Class 3 cases must be either relined or remade, and therefore the repairs are considered but temporary.

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EARLY POSTOPERATIVE AMBULATION

As a result of getting patients out of bed on the first postoperative day and increasing their activity as tolerated with respiratory exercises, circulatory and pulmonary complications have been reduced to a minimum, intestinal function has been restored without enemas and the period of morbidity and disability has been diminished 50 percent or more.

There are several important postoperative reflexes originating from wounds and traumatized areas which initiate pathologic changes leading to complications. The effect of the reflex to the diaphragm can be measured and expressed in the percentage of reduction of vital capacity. In some instances the reduction is over 60 percent on the first post-operative day, and seven to fourteen days are usually required for vital capacity to return to normal. Pulmonary complications increase in direct proportion to the reduction in vital capacity.

In the presence of pulmonary complications, coughing in the standing position, if instituted during the first twenty-four hour period (when the vital capacity is at its lowest level), will invariably promptly expel the mucus and cause prompt disappearance of the râles.

Coughing in the standing position is particularly effective, since the downward pull of the abdominal contents lowers the diaphragm, permitting air to enter the collapsed tubules beyond the mucous plugs.

The curve of postoperative vital capacity is also an index of the stage of convalescence. Recovery after an abdominal operation improves with the improvement of this curve.—Leithauser, D. J.: Confinement to bed for only twenty-four hours after operation; a means of preventing pulmonary and circulatory complications and of shortening the period of convalescence. Arch. Surg. 47: 203–215, August 1943.

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EDITORIALS

DIAGNOSIS VS. THERAPY

Throughout the early decades of the present century medical education emphasized diagnosis. Whether unduly or not, is open to question. Certainly the medical educator appeared engrossed in the recognition of symptoms and signs whereby diseases could be identified and classified. With zeal, he devoted his talents to observing and cataloging pathologic processes under fixed names. Early diagnosis to him constituted the essence of good medical practice and all his energies were directed to this end.

Once a diagnosis was established his endeavor frequently terminated abruptly. In surprised concern he parried the query of an effective therapy. Inferentially at least he taught that knowledge of the cause evoked appropriate therapeutic application.

Doubtless his quandary was attributable to lack of conviction regarding the remedial value of the drugs of the day. To his credit however it must be said that he appreciated that very few remedies were even expected to deal with the causes of diseases. At best, alleviation of symptoms was all that could be expected.

Perhaps it was this tacit admission of inability to cope with disease processes from a remedial standpoint that turned him in his futility to the study of preventive medicine. With what success, the records of present-day achievements admirably portray. Tetanus, typhoid, smallpox, diphtheria, and others, are but a few of the diseases rapidly becoming medical curiosities.

While these studies on toxins and antitoxins occupied medical research, the germ of chemotherapy was being seeded.

Ehrlich[1] was complaining that pharmacology offered nothing relevant to banishing malarial parasites from the blood. Chagrined, he set out to develop a chemical more effective in this regard than quinine. His search for a direct remedy led him to the introduction of dyes and their analogous substances in combatting disease processes.

Organic arsenicals soon appeared with the discovery of atoxyl and indirectly at least became responsible for salvarsan, mapharsen and the like.

Diamines such as diamido stilbene (stilbamidine) provoked pentamidine and propamidine.

[1] Dale, H.: A prospect in therapeutic. Brit. M. J. 411–416, Oct. 2, 1943.

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Introducing the sulfa radical into azo dyes for the purpose of fixing the staining properties of silks and wools opened the way to trial of these compounds in their therapeutic effect on bacterial infections.

The antibacterial properties of acriflavine were reported about this time, while prontosil quickly followed with dramatic success. Exploitation of prontosil chemistry brought out sulfapyridine, sulfathiazole, sulfadiazine, sulfamerazine, and a host of others, the bacteriostatic properties of which seem only recently to be rivaled by the antibiotics, gramicidin, and penicillin.

Today these so-called miracle drugs tend to place overemphasis on therapy. Diagnosis too frequently is becoming a question of therapeutic trial and error. Therapy from a standpoint of practice is being narrowed to sulfonamides as preventives. What modification penicillin will make on this situation depends upon the availability of its supply.

There is evidence however that a trend towards retrenchment on the indiscriminate use of these substances is underway. Application only when indicated by specific diagnosis is advocated by some even for injuries sustained in battle areas.

With the knowledge that the action of sulfonamides when applied locally is attributable to systemic absorption, local application should be more than one of simple prescribed routine.

On the other hand, the statement that hypersensitization is developed from repetitious small doses of the drug for minor injuries or skin lesions appears fallacious, especially in light of the recent work associating sensitization to known blood grouping factors. Indiscriminate use, or use in subtherapeutic doses has, rather, its complement in drug fastness—a situation not serious, now that it is proved that "fastness" for one drug does not necessarily connote the same property for the other. Sulfonamide fastness may be overcome by the administration of penicillin, equally as readily as penicillin fastness may be side-stepped by use of one of the sulfa drugs.

Irrespective of how phenomenal these drugs may appear, they are not panaceas. Accurate diagnosis should precede rational therapy even as cause should precede effect. Therapeutic diagnosis, however importunate, should be a last resort and not the occasion for experimental try-alls. Empiricism in medicine should stimulate investigation and end in the conclusions of scientific research.

GASTRO-INTESTINAL DISEASES IN THE NAVY

The old adage "an army marches on its stomach" is no less applicable to the Navy. Pertinently expressed by one of our Marines, "A sick Marine is a dead Marine as far as combat service is concerned."

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Disabilities of a gastro-intestinal nature have been of captain rank in naval medical history. Contemporary history, however, has shown astounding progress in eliminating the incidences of these outbreaks in Naval service. Food poisonings aboard ship are of so rare occurrence that they are made occasions of record in medical literature.[1] Improved sanitary methods, personnel hygiene, mechanical refrigeration and storage plants have contributed substantially to this success.

There was a time not far back when typhoid fever was an accepted part of any military campaign. Today it is interesting to note[2] that a single case of typhoid recently admitted to the sickbay of one of our larger hospital ships created such a surge of interest as to be equalled only by a disease of the most rare occurrence.

In a list of present-day gastro-intestinal disorders, infectious dysenteries are relatively low in frequency in alimentary diseases. Dyspepsia, peptic ulcer, and dysfunction of the vegetative nervous system have become major disabilities in this global war. The seriousness of peptic ulcer in the armed forces has already attracted much attention,[3] as has the problem of disposition of these patients.

There was a time when syphilis lay ominously in the background of any clinical study. Diagnosis was held in abeyance until the return of the Wassermann report. The arch masquerader had to be eliminated before any degree of certitude in diagnosis could be attained. Though still rampant, syphilis is rapidly being superseded in this respect by malaria. With the tremendous reservoir potentiality occasioned by the returning of troops from endemic areas, malaria in its many and varied forms in increasing frequency will require medical emphasis second only to syphilis. The algid, choleriform and dysenteric types are already being observed in their exotic roles and must of necessity enter into any discussion of gastro-intestinal diseases in the future.

Characterized by gastro-intestinal distress that may simulate anything from acute appendicitis to a simple psychogenic diarrhea, these masqueraders may be disguised under a syndrome of nausea, vomiting, running of the bowel, and bloody stool. Examination of the blood, however, will quickly reveal the true nature of the illness.

The time is not far remote when, paralleling the Wassermann and Kahn tests of today, every complete diagnostic procedure will of necessity include a blood-smear examination for malarial parasites.

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[1] Tipton, V. C., and Smiley, D. F.: Ham-borne staphylococcal food poisoning. U. S. Nav. M. Bull. 41: 565–573, March 1943.

[2] Aston, M. J., and Kern, R. A.: Wartime experiences of a U. S. Naval Hospital Ship. In press.

[3] Editorial this BULLETIN, November 1943, p. 1756.

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BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.

(For review)

—

MANUAL OF FRACTURES, Treatment by External Skeletal Fixation, by *C. M. Shaar, M. D., F. A. C. S., Captain, Medical Corps, United States Navy;* and *Frank P. Kreuz, Jr., M. D., F. A. C. S., Lieutenant Commander, Medical Corps, United States Navy.* 300 pages; 148 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1943. Price $3.

This is a well-written and generously illustrated volume devoted to the application of the Stader splint and its manipulation in the reduction and management of fractures of all the principal bones of the body. It is surprising how such a small volume covers so comprehensively the subject of fracture therapy by external fixation.

To one anchored in a ship's berth by weights, ropes, and pulleys, the thought of abandoning ship must be most depressing. If for no other reason the principles advocated by the authors are worthy of earnest study and application. Global war has projected into the fore the sea transportation of wounded over many miles of dangerous waters. To adapt fracture management to ship design in order that the handling and emergency removal of orthopedic cases can be expedited is a progressive step.

However, this is admittedly only a phase of fracture management by external fixation. Nor is it intended that the time-tried plaster immobilization be discarded for metal appliances. In selected cases plasters still are considered the ideal form of therapy.

Although the factor of reduction of fractures by such devices have recently been discussed unfavorably, still under war duress and in isolated stations a decided advantage can be seen in this method of apposing bony fragments.

To condemn without the virtue of trial or without cognizance of the errors of manipulation involved, to say the least, is an unscientific approach. Chapter VII consequently is devoted to a discussion of the common errors encountered in the treatment of fractures by

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external fixation and must be considered whenever appraisal of this technic is undertaken.

The last chapters devoted to anesthesia in fracture work and roentgen study in the healing of fractures fittingly conclude a timely treatise on an important orthopedic topic.

ALLERGY, by *Erich Urbach, M. D., Chief of Allergy Service, Jewish Hospital, Philadelphia;* with the collaboration of *Philip M. Gottlieb, M. D., Associate on Allergy Service, Jewish Hospital, Philadelphia.* 1,073 pages; illustrated. Grune & Stratton, New York, publishers, 1943. Price $12.

The bridge of time from "idiosyncracy" to "anaphylaxis" and "allergy" is such a brief one, well within the years of practice of our older men, that the specialty of allergy seems still a pushing upstart. The heading "Allergy" did not appear in the Index Medicus until 1923.

In the brief life of this youngster, a number of textbooks have appeared, but it is doubtful if any more comprehensive coverage exists than in this newest volume. The 1,100 pages embrace all aspects and phases without any unnecessary padding. Illustrations are abundant and clarifying. Causative agents are classified as inhalants, ingestants, injectants, contactants, infectants, and physical and parasitic agents.

Skin reactions are so comprehensively treated that the book seems almost a textbook of dermatology. There are 233 pages on allergic diseases of the respiratory and gastro-intestinal tracts with additional chapters on cardiovascular and hemapoietic systems, joints and urinary tract. Menstrual, placental and fetal, and menopausal reactions are discussed sensibly. The nervous system, the eye, the ear are excellently covered, as also is the field of the industrial hygienist.

It is needless to say that diagnosis and therapy are exhaustive; but always in a presentable manner. This is a most satisfactory volume. As a last word on allergy and for a comprehensive view of the entire field it is whole-heartedly recommended.

AIR-BORNE INFECTION, Some Observations on Its Decline, by *Dwight O'Hara, M. D., Professor of Preventive Medicine, Tufts College Medical School; Visiting Physician, Boston City Hospital.* 114 pages. The Commonwealth Fund, New York, publishers, 1943. Price $1.50.

This book is of particular interest to those concerned with preventive medicine as it points out the contributory factors which have reduced the incidence and severity of certain respiratory diseases during the past few decades. The diseases considered are smallpox, diphtheria, pneumonia, the common cold, influenza, tuberculosis, the streptococcic infections and rheumatic fever. The courses of these infections are described by correlating clinical data, mortality and morbidity rates, public health measures, the rise of living standards, natural amelioration and chemotherapy. Yet, all these factors do not

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seem sufficient to account for the reduction in these diseases so the author feels there is an unknown factor working in conjunction with medical and sociological efforts which must be understood to improve on the present benefits.

Naval medical officers may be consoled by the view that yearly attacks of the common cold keep us from becoming immunologically soft. In the same trend the author states he has become a firm believer in the old-fashioned idea of getting the childhood diseases and being done with them. He feels that as long as measles, mumps, chicken pox, and perhaps pertussis continue to kill less than two per 100,000, we are getting first-class immunity cheaply. Many will disagree.

The book represents an earnest and interesting attempt to mirror the past and present histories of these infections and although the subject is tremendous, it is dealt with thoughtfully and considerately.

THE THERAPY OF THE NEUROSES AND PSYCHOSES, A Socio-Psycho-Biologic Analysis and Resynthesis, by *Samuel Henry Kraines, M. D., Associate in Psychiatry, University of Illinois, College of Medicine.* Second edition, thoroughly revised. 567 pages. Lea & Febiger, Philadelphia, Pa., publishers, 1943. Price $5.50.

Considering the rapid change in the amorphous state of psychiatric therapy, it is most advantageous that those therapeutic practices which are generally accepted be correlated. Unfortunately, there are few texts which accomplish this. Perhaps it is a characteristic of the chaotic state of knowledge that most authors, presumably writing on therapy, confine their attentions to problems which more properly belong to a philosophical discussion of psychopathology.

Dr. Kraines' book is a haphazard guide through the maze of data on psychiatric treatments. In his attempt to survey the entire field, he neither affords a comprehensive over-all picture; nor does he critically particularize with any greater benefit. The lack of coherence and unity is discomforting.

Of the too-few pages on therapy alone, he devotes four to a detailed presentation of the generally unsuccessful 'Keeley Cure' for alcoholism while in two pages he deals with the entire subject of medication as an adjunct to general psychotherapy. Dr. Kraines' review of headache fails to include mention of either migraine or the histamine varieties. Further, his discussion of the therapy of insomnia does not specify the possibilities available in the choice of sedatives. The treatments which he does recommend are both vague and arbitrary.

A flagrant inconsistency is noted in the section which deals with the psychosomatic disorders. The entire argument for holistic thinking is defeated when he dignifies isolated, individual symptoms considering them in the light of syndromes, presumably amenable when treated as such.

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The 32 pages devoted to the neuropsychiatric states in wartime could have well served as the model for the remainder of the book. It is to be regretted that it was not amplified.

"The Therapy of the Neuroses and Psychoses" is not recommended.

GASTRO-ENTEROLOGY (in three volumes), by *Henry L. Bockus, M. D., Professor of Gastro-enterology, University of Pennsylvania Graduate School of Medicine.* Volume I—The Esophagus and Stomach. Examination of the Patient, and Diagnosis and Treatment of Disorders of the Esophagus and Stomach, including Duodenal Ulcer. 831 pages; 294 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1943. Price $35 for 3 volumes and separate desk index.

In view of the large number of gastro-intestinal patients seen in any practice of medicine this work is a very important contribution to the field of medical books. The book is practical and very comprehensive, covering applied physiology, the laboratory and physical examinations as well as the diagnosis and treatment. The methods of treatment are usually taken from the author's large personal experience, hence are proved clinically and are given in detail. It is well illustrated with pictures and clinical cases and has an excellent and large bibliography. The binding, as is usual with this publisher's books, is excellent. If the second and third volumes are as satisfactory as the first, this set should prove to be a very popular and valuable reference for all who work in this field of clinical medicine.

TRANSURETHRAL PROSTATECTOMY, by *Reed M. Nesbit, M. D., F. A. C. S., Associate Professor of Surgery, University of Michigan Medical School, in charge of the Section of Urology, Department of Surgery.* 192 pages with 92 drawings illustrating technique by *William P. Didusch.* Charles C. Thomas, Springfield, Ill., publishers, 1943. Price $7.50.

The author has presented a clear, concise, and detailed résumé of the whole subject of transurethral prostatectomy. From the first chapter on the vascular supply of the prostate by Dr. Flocks, through the chapters on preoperative care, technic of operation, and postoperative care the reader is carefully and painstakingly guided past every step in a systematic and planned procedure for the removal of the prostate gland by transurethral surgery. The comments on fluid balance in the healthy individual and the fluid requirements of the diseased patient should prove significant not only to the urologist but also to the general surgeon.

The author is extremely enthusiastic about transurethral surgery and, although the individual results appear slightly more favorable than those recorded by the majority of resectionists over the country, the reader is impressed by Dr. Nesbit's faith in the operation and the great emphasis placed on sound, basic principles and careful execution of technic.

The physical makeup of the book is good. The illustrations are numerous, clear and informative. The book should prove of great value

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to the young man contemplating the field of prostatic surgery, and to the experienced surgeon it should be interesting as a personal review of a highly technical surgical procedure.

FIRST AID, Surgical and Medical, by *Warren H. Cole, M. D., F. A. C. S., Professor and Head of the Department of Surgery, University of Illinois College of Medicine; Lieutenant Colonel Charles B. Puestow, Medical Corps, United States Army;* and *17 collaborating physicians.* Second edition. 351 pages; illustrated. D. Appleton-Century Co., Inc., New York, publishers, 1943. Price $3.

The marked industrial development of our country and the increase in automobile accidents during the past few decades have greatly increased the importance of first aid. It has been popularized to the civilian population by safety-first campaigns, the Red Cross and other social agencies. But since the advent of war the importance of first aid has increased enormously. At present many medical schools stress the teaching of such courses to their students.

Compared to the many other manuals on this subject, this book is to be regarded as more appropriate for advanced students in first-aid methods, and should be particularly valuable in preparing medical students for service in the armed forces as well as in refresher courses for medical officers.

The book is well outlined and clearly written. It gives considerably more detailed facts on the usual topics covered by more elementary manuals. Medically accurate and detailing the latest approved procedures, it is an authoritative guide in the handling of war injuries as well as those of industry and civilian life. Medical as well as surgical emergencies are given proper consideration. Subjects such as wounds, burns, hemorrhage and shock are discussed in considerable detail. When dealing with emergencies of the military type, methods in use in our armed forces are stressed. Among these, bandaging, wound cleansing, wound dressing, splinting and transportation of the wounded are discussed fully. In all, it is a most practical treatise, valuable alike for medical students, practitioners and medical personnel of the Army and Navy.

ATLAS OF OBSTETRIC TECHNIC, by *Paul Titus, M. D., Obstetrician and Gynecologist to the St. Margaret Memorial Hospital, Pittsburgh; Secretary American Board of Obstetrics and Gynecology.* Illustrations by *E. M. Shackelford, Medical Illustrator, John C. Oliver Memorial Research Foundation, St. Margaret Memorial Hospital, Pittsburgh.* 180 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $7.00.

The purposes for which this book is intended are adequately fulfilled; namely, as a pictorial supplement to obstetrical texts or as a necessarily quick picture reference before an operative obstetrical procedure.

The atlas is largely composed of drawings illustrating obstetric tecnic with very brief yet sufficiently explanatory remarks by the

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author. Also included is a 10-page section on sterility with diagnostic and operative illustrations. There is no crowding of the material presented. The pages are 8½ by 11½ inches and nicely bound with a blue cloth cover. An additional feature is the insertion of blank pages at the end of each section for personal notes or sketches by the operator or student. Both the artist and author should be commended on the illustrations, captions and arrangement of material.

This book could be of assistance to anyone practicing obstetrics, its greatest value being an aid to the student and general practitioner.

THE INNER EAR, Including Otoneurology, Otosurgery, and Problems in Modern Warfare, by *Joseph Fischer, M. D., Staff Member, Beth Israel Hospital, Boston;* and *Louis E. Wolfson, M. D., Instructor in Ear, Nose, and Throat, Tufts Medical School.* 421 pages; illustrated. Grune & Stratton, New York, publishers, 1943. Price $5.75.

As the authors state in their preface, almost every topic occurs twice—once in the chapters on physiology where various theories and hypotheses are brought out, and again in the chapter on functional tests, where indications, technic and clinical evaluation of the various tests are critically described. This permits an easy method of finding the information sought.

Inasmuch as one of the authors has had many years of experience in postgraduate teaching in the clinics of Politzer and Alexander, a very technical and difficult subject is handled in workmanlike manner. The subject matter, particularly on the labyrinth and the complex matter of otoneurology, is of interest particularly to advanced students and specialists only, and is hardly recommended for beginners in otology.

The last three chapters in the book, namely those on war trauma, the role of the inner ear in aeronautics, and effects of atmospheric pressure changes on the ear, do not do the first part of the book justice. They are elementary and are merely a rehash of well-known facts readily available in the numerous texts and articles on aviation medicine and war medicine.

The illustrations and photomicrographs are numerous, clear and well selected. The printing is clean and on good stock and the binding is of sturdy construction.

PHYSIOLOGY IN AVIATION, by *Chalmers L. Gemmill, B. S., M. D., Commander, Medical Corps, United States Naval Reserve; Associate Professor in Physiology, Johns Hopkins University School of Medicine, Baltimore, Maryland; Instructor in Physiology, School of Medicine, Naval Air Station, Pensacola, Fla.* 129 pages with 18 figures and 18 tables. Charles C. Thomas, Springfield, Ill., publishers, 1943. Price $2.

This new book on aviation medicine, although almost of pocket size, gives to the flight surgeons a brief but concise reference on problems which face them daily. This book is composed of the lec-

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tures in physiology given at the School of Aviation Medicine, at the Naval Air Station, Pensacola, Fla., and has one chapter on the effects of instrument flying written by a naval aviator.

The physiology of respiration, the effects of anoxia, the use of oxygen in aviation, aero-embolism, the effects of acceleration on man, the temperature control of the body, and the effects of instrument flying are covered concisely and clearly.

The greater part of the book could be read and understood by the average pilot. There has been a great need for just this type of a book and it should be part of the equipment of all flight surgeons. All pilots should be urged to read this excellent volume.

PERIODONTAL DISEASES, Diagnosis and Treatment, by *Arthur H. Merritt, D. D. S., M. S., F. A. C. D., F. A. A. P.* Second edition. 205 pages; illustrated. The Macmillan Co., New York, publishers, 1943. Price $3.75.

Once again Dr. Merritt has carved another rung in the ladder to a more thorough understanding of the disease process and the more universal acceptance of nomenclature regarding the much abused and misleading condition of so-called "pyorrhea." The text is a well bound, cloth-covered volume of concise and directive nature. All nonessential and irrelevant matter, as well as all obsolete theories, have been eliminated when possible, thus making for more easy perusal and study of the accepted theories of diagnosis, etiology, treatment, and postoperative care of periodontal diseases.

The classification of periodontal disorders, strictly to the point and easily comprehensible, is divided into four basic types which in turn are subdivided according to etiology, symptomatology, or bacterial intervention.

The great majority of the text, however, is concerned with one of the most common of all diseases of the investing structures of the teeth, namely, periodontoclasia. The author has gone into a lengthy clear-cut discussion of this subject, propounding, in conjunction with his own theory on this matter, the theories of Kronfeld, Black, Gottlieb, and Broderick. The conservative, radical, and "the middle of the road" treatments and postoperative care are dealt with in detail. Also included in the text are invaluable hints as to the sequelae of events which might manifest themselves in the surrounding tissues and the dental pulp, and their subsequent treatment.

Throughout the entire text are very accurate and enlightening microscopic and macroscopic photographs.

OPERATIVE ORAL SURGERY, by *Leo Winter, D. D. S., M. D., F. A. C. D., F. A. C. S., Sc. D. (Hon.), LL. D., Professor of Oral Surgery, New York University.* Second edition. 1,074 pages with 1,211 text illustrations, including 10 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $12.50

This book covers a wide range of subjects pertinent to the oral surgical field with an abundance of illustrations. There are 1,211

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interesting reproductions of photographs, sketches and roentgenograms.

The first edition, published in 1941, has been enlarged in the present work to include 7 additional chapters. These new chapters modernize the text by consideration of "chemotherapy, shock, burns, war wounds, dislocation, and subluxation of the temporomandibular articulation, and pin fixation or skeletal fixation for treatment of fractures." The last chapter gives a résumé of the more commonly used methods of skeletal fixation as applied to jaw fracture cases.

E. A. Rovenstine, Professor of Anesthesia, New York City, contributes a well-written chapter on general anesthesia for oral surgery operations which includes technics for the open, semiclosed, and closed methods of anesthetic administrations.

The author's direct approach to the subject matter, simplicity of expression, and avoidance of controversial theories tend to present an easily readable book which should adequately serve its intent of being a "clinical guide."

TEXTBOOK OF MEAT HYGIENE, With Special Consideration of Antemortem and Postmortem Inspection of Food-Producing Animals, by *Richard Edelmann, Ph. D., Late Medical Counsellor.* Eighth revised edition by *John R. Mohler, A. M., V. M. D., D. Sc., Chief United States Bureau of Animal Industry;* and *Adolph Eichhorn, D. V. D., Director, Animal Disease Station, United States Bureau of Animal Industry.* 468 pages; illustrated with 169 engravings and 5 colored plates. Lea & Febiger, Philadelphia, Pa., publishers, 1943. Price $5.50.

The eighth edition of this work is timely because of the increased necessity for careful inspection and vigilant control of meat and meat products. Primarily intended for veterinarians and packing house superintendents, the work is a helpful reference book for the medical officer who may be called upon to pass judgment as to whether meat is fit for human use. Of particular interest is the chapter devoted to the diseases of man which may result from consumption of spoiled or contaminated meat.

The book contains well-chosen illustrations, some in color. The charts depicting the various wholesale and retail cuts of meat are of general interest.

STUDY GUIDE TESTBOOK IN ANATOMY AND PHYSIOLOGY, by *Carolyn E. Gray, A. M., R. N.; and Caroline E. Stackpole, A. M., Associate in Biology, Teachers College, Columbia University.* Based on the Textbook of Anatomy and Physiology, Eleventh edition, by Diana C. Kimber, Carolyn E. Gray, and Caroline E. Stackpole. Fifth edition. 106 pages. The Macmillan Co., New York, publishers, 1943. Price $1.15.

The purpose of this book is to aid the student in the study of anatomy and physiology and the instructor in the preparation of

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lessons and the conducting of written quizzes. The subject is very well covered and should be of great help to the student under peace-time conditions. The arrangement of the material is sufficiently flexible to suit most teaching conditions that may arise.

In considering this guide for use in Hospital Corps instruction, it is noted that it covers too much in detail certain phases of anatomy and physiology that have been considered unimportant in our speed-up system of instruction in use at the present time. The illustrations and diagrams are excellent.

A HISTORY OF NURSING, by *Deborah MacLurg Jensen, R. N., M. A., Lecturer in Nursing Education, Washington University, St. Louis.* 310 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $2.75.

The approach to a history of nursing that has been used here by the author is a good one. The book begins with a discussion of the economic background and continues through the evolution of modern medicine to the development of the hospital. The history is not correlated with events in world history that paralleled nursing progress. Excellent references for supplementary reading are found with each chapter.

TEXTBOOK OF ANATOMY AND PHYSIOLOGY FOR NURSES, by *Carl C. Francis, A. B., M. D., Senior Instructor in Anatomy, Department of Anatomy, Western Reserve University, Cleveland, Ohio; G. Clinton Knowlton, Ph. D., Assistant Professor of Physiology, College of Medicine, State University of Iowa;* and *W. W. Tuttle, Ph. D., Professor of Physiology, College of Medicine, State University of Iowa.* 586 pages with 338 text illustrations and 39 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $3.50.

This book has been planned with the needs of nursing education in mind. It is a text written to present the subject in a concise way; therefore, facts of minor importance are omitted. It could for this reason be used rather well as a handbook for quick reference.

Anatomy has been treated in a more thorough way than has physiology. The chapters on muscles and on the nervous system are complete discussions but here, as in other parts of the book, the student may experience difficulties with some of the advanced terms that have been used. A glossary, however, is appended.

A commendable feature is the way this text is illustrated. Most of the drawings, some in color, are used here for the first time and should help considerably the reader's understanding of the written material. New ideas in illustrating anatomy are used quite satisfactorily. This book should meet the requirements of the educator in need of a condensed book on this subject.

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PRINCIPLES AND TECHNIQUES OF NURSING PROCEDURES, As Developed in St. Mary's Group of Hospitals of St. Louis University, by *Sister Mary Agnita Claire Day, S. S. M., R. N., B. S. in Nursing, State University of Iowa; M. S. in Nursing, St. Louis University; Instructor in Medical Nursing, St. Louis University School of Nursing.* 574 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $3.50.

This is an up-to-date book that gives information on some of the latest improvements in nursing procedures. It uses a well planned outline form that makes it an easy book to study. In one or two paragraphs the underlying principles of a procedure are set forth, general instructions follow; then requisites for the treatment are listed. The technic is described in numbered steps and finally, directions for recording the work are given. Where necessary attention is called to precautions that should be taken and to those observations that might be of greatest significance.

The mental and physical aspect of the patient's care is dealt with strongly. A bibliography and suggested readings follow the chapters. The illustrations are original ones; the diagrams are useful. The authors realize that technics vary in different hospitals and have, therefore, presented them so that they may be modified.

The book is good as a reference and should fit the needs of beginning students in nursing schools. It is not the complete treatment of the subject that Harmer and Henderson have accomplished and so does not replace that text. Additional reading would be required.

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PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

STUDY OF SULFATHIAZOLE IN CALOMEL OINTMENT AS A PROPHYLAXIS FOR GONORRHEA

A PRELIMINARY REPORT

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The efficacy of the sulfonamides orally in the treatment of gonorrheal urethritis has become a well-established fact. Stedman (*1*) reported the use of urethral instillation of a 5-percent suspension of microcrystalline sulfathiazole as a prophylaxis for gonorrhea in 297 cases. Effective results were obtained in all except two cases. Greenblatt et al. (*2*) demonstrated that the addition of sulfathiazole in sufficient concentration to calomel ointment to result in a mixure containing at least 20 to 25 percent of sulfathiazole, proved promising in an experimental group of volunteer patients. Successful prophylaxis resulted in 25 of 34 inoculations. Calomel ointment alone proved ineffective under similar circumstances. With the aforesaid findings in mind, the use of sulfathiazole in an ointment locally as a prophylaxis for gonorrhea seems feasible.

It should not be overlooked that such an ointment should contain calomel in addition to sulfathiazole, even though intra-urethral chancres are considered rather infrequent. In this study an ointment of the following formula was used:

	Gm.
Sulfathiazole powder	4.00
Mercurous chloride, mild	8.00
Woolfat, anhydrous	8.00
Petrolatum, white	8.00

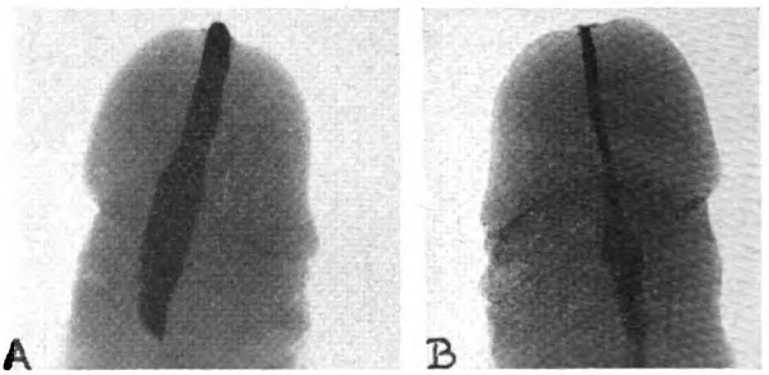
This preparation was tested on 100 individuals for the purpose of determining its irritability on the urethral mucous membrane. No discomfort was experienced at the time of injection nor did any develop a chemical urethritis.

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METHOD OF SUPERVISED PROPHYLAXIS WITH SULFATHIAZOLE-CALOMEL OINTMENT

1. Urinate.
2. Wash private parts thoroughly with soap and water.
3. Dry thoroughly.
4. Inject 1 gm. of this ointment into the urethra and close meatus by compressing with finger tips.
5. Massage for three minutes.
6. Avoid urination as long as possible.
7. Apply calomel ointment to other parts and massage for 5 minutes.

Figure 1 (A) shows a urethral shadow in direct contact with the mucous membrane after injection of 1 gm. of sulfathiazole-calomel ointment. Figure 1 (B) demonstrates the retained ointment after three hours, during which interval there was no urination.



1. (A) Sulfathiazole-calomel ointment injected into urethra. (B) Three hours after injection.

In this preliminary report, the study was made on personnel who reported for prophylaxis at the central prophylaxis station, San Diego, and at the border station, Tijuana, Mexico.

This type of prophylaxis was administered only to those who did not use a sheath or other prophylactic measure prior to reporting for treatment.

During this three-month survey, 2,016 received intra-urethrally the sulfathiazole-calomel ointment as a prophylaxis for gonorrhea. Due to different types of contacts in the Tijuana and San Diego area, it seems logical to separate the cases into two groups. One thousand twenty-five were administered to those having exposure in Tijuana. Ninety-eight percent of this group contacted prostitutes. Nine hundred ninety-one treatments were received by those having exposure in San Diego. One infection of gonorrhea was reported in each group, although after investigation it was revealed that both cases failed to report within two hours after exposure, the maximum time considered safe for successful prophylaxis.

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TABLE 1.—*Infections which resulted from exposures in Tijuana and San Diego (3 months)*

Type and number of cases	No prophylaxis	Self-administered prophylaxis			Supervised prophylaxis	
		Sheath	Calomel-ointment tube	Other type	Silver and calomel ointment	Method under study
Gonorrhea (212)	140	28	30	12	6	[1] 2
Syphilis (10)	4	3	2	1	0	0
Chancroid (0)	0	0	0	0	0	0
Lymphopathia venereum (0)	0	0	0	0	0	0

[1] Failed to report for treatment within 2 hours after exposure.

SUMMARY AND CONCLUSIONS

1. In this preliminary study, 2,016 treatments were administered to a selected group who had not used any prophylactic measures prior to reporting for treatment.

2. Two failures were reported; both had failed to report for treatment within two hours after exposure.

3. Experimental studies by previous investigators have clearly demonstrated the efficiency of sulfathiazole in calomel ointment as a prophylaxis against chancroidal infection.

4. A combined sulfathiazole-calomel ointment used intra-urethrally has proved its efficiency as a prophylaxis against gonorrhea. Ninety-eight percent of one group had been exposed to known prostitutes.

5. It is hoped that the addition of sulfathiazole to calomel ointment will not minimize the effectiveness of calomel as a prophylaxis against syphilis.

6. Further studies with sulfathiazole in calomel ointment as a prophylaxis against chancroid, gonorrhea, and syphilis seem desirable.

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OBSERVATIONS ON THE AMBULATORY TREATMENT OF GONORRHEA

NAVAL AIR STATION, QUONSET POINT, R. I., 1 APRIL 1942 TO 1 APRIL 1943

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On this station when a man reports at sick call with uncomplicated acute gonorrhea he is not hospitalized. As a result, the number of

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working man-days lost to the Navy from gonorrhea has been exceedingly small.

Protective restriction against the spread of the disease is accomplished by restricting liberty until the patient is pronounced cured.

Fortunately the incidence of gonorrhea on this station is relatively low. During the 1-year period under consideration, only 132 new cases of acute gonorrhea were seen, a general average of 11 cases a month. Actually the number of cases by months has been as follows:

	Cases		Cases
April 1942	17	November 1942	13
May 1942	8	December 1942	10
June 1942	2	January 1943	21
July 1942	7	February 1943	9
August 1942	7	March 1943	17
September 1942	9		
October 1942	12	Total	132

The smallest number of cases were during the summer months, which is not what would generally be expected. During the first 6 months there were an even 50 cases and during the second 6 months 82 cases. This represents an increase of 64 percent in the second 6 months over the first 6 months, but during the second half the number of personnel on the station jumped 250 percent. The 132 cases include 45 cases contracted outside the Providence, R. I., area, but which were brought to this station in the acute form.

The figure does not include a dozen or more protracted cases transferred to us from a neighboring activity for hospitalization because of their failure to respond to such treatment as could be administered to them by the limited facilities of the originating activity. In this article, except in the discussion of complications, only those cases are considered which were contracted in the Providence, R. I., area, and in which all treatment was in this clinic.

Treatment has consistently started with sulfathiazole. The daily dosage and the number of days the drug has been given have varied.

The results obtained with sulfathiazole alone have not been eminently satisfactory. In this our primary objective of keeping the men on the job may be one factor. Of the 87 cases on whom treatment was started with sulfathiazole, only 49, or 56.3 percent, were cured by sulfathiazole therapy alone. Criterion of cure consists not only of absence of urethral discharge with a clear urine, but also of negative smears of the prostatic fluid.

The other 38 cases, or 43.7 percent, have required supplementary therapy in the form of urethral irrigations and instillations, prostatic massages, and subsequent courses of sulfathiazole. Only a few definitely chronic cases have been instrumented. Treatment is occasionally protracted; but it should not be forgotten that before the

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advent of the sulfa drugs 6 weeks to 6 months was almost a routine in treatment.

In intractable cases we have alternated supplementary therapy and sulfathiazole several times; rarely over three times before effecting a cure. We have not been impressed with any beneficial effect from another sulfa drug after the failure of a reasonable course of sulfathiazole.

Routine dosage consisted at first of 3 gm. of sulfathiazole daily for 2 or 3 days, depending on how purulent the urethral discharge was when first seen. Then 2 gm. were given daily for 8 to 10 more days depending on how quickly the discharge disappeared and the urine cleared up. Bicarbonate of soda was not given along with the sulfathiazole. Patients were told to force fluids to 15 glasses in 24 hours. A leukocyte count was done before the drug was started and on every third to fifth day thereafter as indicated. Arbitrarily the drug was discontinued if the leukocyte count went below 6,000.

Some patients have experienced mild to moderate anorexia. A few have shown urinary crystals but there has been no oliguria or hematuria. Only one patient developed any sensitivity. An attempt to give him a second course of sulfathiazole resulted in a severe skin reaction from one 0.5-gm. tablet. A number of patients had more than one course of sulfathiazole, enough to have given us reactions if they are very common. Especially does this apply to those who came to us from the adjacent activity, all of whom had had in the neighborhood of 50 gm. of sulfathiazole before transfer to us. We had several patients who had had sulfathiazole for a previous gonorrhea on other duty, and there were four patients who had gonorrhea twice during their stay on this station. These cases were not recurrences; fresh exposures were admitted.

Beginning in February we increased the dosage to 4 gm. of sulfathiazole daily for 5 days. In these ambulatory, full-duty patients (no light duty slips) there were as many failures as with the previously outlined dosage. The increased dosage stopped the discharge on the average a little more promptly, though in most successful cases the discharge ceased within two days with either dosage. However, not infrequently, we found recurrence of discharge and positive smears. This led to the conclusion that for ambulatory cases one should continue the drug for at least 10 days.

The present routine is 4 gm. of sulfathiazole daily for 3 days, 3 gm. daily for 4 days, and 2 gm. daily for 3 days, a total of 30 gm. in 10 days. This is followed by a rest period of 3 to 5 days.

It is unwise to take a prostatic smear too soon after completing the course of sulfathiazole. This is particularly true in the long-standing cases that have received more than one course of sulfathiazole. The smear may be negative when taken the day the sulfa drug was dis-

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continued, but a repeat staining 1 week to 10 days later, without the reappearance of any discharge, may be again positive for the gonococcus.

In the 49 cases cured by sulfathiazole alone, the urethral discharge ceased within 2 days in 26 cases, within 3 days in 9 cases, within 4 days in 7 cases, and within 5 days in 7 cases. The average dose of sulfathiazole was 26 gm., given over 11 days. A few cases responded to the shorter course of 20 gm. in 5 days. The usual number of prostatic massages given was 3 to 4; some cases, however, received as many as 10. The average length of time for a patient to be under treatment or observation was 3½ to 4 weeks. A routine blood Kahn was taken at the end of 6 weeks.

Any discussion of the treatment of gonorrhea by sulfathiazole may well contain an observation regarding its use as a prophylactic agent. At this station anyone reporting in for venereal prophylaxis over 3 hours after the time of exposure, receives in addition to a regular Navy prophylaxis administered by a hospital corpsman, 1 gm. of sulfathiazole, and then one-half gm. every 4 hours for 3 days. Three days later the patient reports for an examination of his urine sediment for any evidence of infection. No patient who has received this regime has developed gonorrhea during the past year.

Only six patients were admitted to the venereal ward because of persistent and resistant purulent urethral discharge with positive smear. Three of the six cases were already on the ward when the present regime was instituted. They remained in 24, 18, and 23 days, respectively. A fourth case was admitted for disciplinary reasons and remained 28 days. Only two of the six cases were admitted as being failures on sulfathiazole therapy. Their urethral discharge persisted or actually grew worse under chemotherapy. The increasing use of sulfathiazole may have rendered certain strains of the gonococcus very resistant to the drug. While the two remained on the ward, one for 7 and the other for 14 days, they progressed favorably, the urine clearing in one case. A few days after they left the ward however the discharge recurred with positive smear. They were not readmitted but were treated as out-patients and kept on duty, with continued improvement.

The confining of patients to bed is not necessarily a therapeutic panacea. Cases with complications, however, have to be hospitalized. During the year there were 2 cases admitted for gonococcus infection, lymph node (a total of 8 days); 2 cases were admitted for acute gonococcus infection, prostate (37 days); 1 case was in for 4 days with a diagnosis of gonococcus infection, joint; and 9 cases were admitted for gonococcus infection, epididymis. They remained from 5 to 21 days for a total of 81 days for all 9 cases. This makes a total of 130 man-days of work lost to the Navy because of gonorrheal complica-

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tions, or less than 1 day each for the total of 132 cases. If we add the number of workdays lost by the few men who were admitted to the ward because of persistent urethral discharge, then there was an average of less than 2 workdays lost for each of the 132 cases.

Currently the venereal restricted list for gonorrhea averages 20 names. If these men were confined to the ward it would take only 12 days for the Navy to lose as many workdays as has actually been lost in a whole year.

SUMMARY

At the Naval Air Station, Quonset Point, R. I., men contracting gonococcus infection urethra are ordinarily kept on duty under ambulatory treatment unless they develop a complication requiring their confinement in the venereal ward.

During the year, 1 April 1942 to 1 April 1943, there were 132 cases of gonococcus infection, urethra, treated in the urological department.

In 87 of the 132 cases the treatment was begun at this station. Of this group 56.3 percent were cured by sulfathiazole alone; the other 43.7 percent required supplementary treatment.

In the total 132 cases, workdays lost to the Navy were kept at a minimum. From all causes only 244 workdays were lost, or an average of less than 2 workdays for each of the 132 cases. Less than 1 workday per case was lost from complications.

EVALUATION OF SULFATHIAZOLE IN THE TREATMENT OF GONORRHEA

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We have noted with regret that the results of our treatment of gonorrhea by the routine administration of sulfathiazole have not been attended with the success commonly cited in the literature. Moreover, informal discussion with other medical officers has not indicated that there is unanimous enthusiasm concerning results of chemotherapy.

There were 26 patients in our small series, all young men between 17 and 30 years of age, the average age being 20 years. Practically all patients reported to the sickbay within a few days after the urethral discharge appeared. Results did not appear to be influenced by the slight difference in the interval of time before reporting for treatment. These men were kept at light work, which might conceivably have affected the results.

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The regime observed in our series involved the following: After a preliminary positive gram-stain of the urethral discharge had been obtained, sulfathiazole therapy was begun in the dosage of 1 gm. at 4-hour intervals at 0800, 1200, 1600, and 2000. Later the dose was increased by giving 1 gm. at 2400 and 0400. At the beginning of the series the drug was discontinued after 7 days, and 2½ percent silvol was instilled urethrally daily for 5 days. Then sulfapyridine was given orally. It was soon decided to continue the chemotherapy over a longer period of time. Serious effects of the drug were averted by careful observation and by repeated blood examinations and urinalyses. The greater part of our study was concerned with the effects of sulfathiazole. Sulfadiazine and sulfapyridine were used to a less extent.

The criterion for cure was the one in common practice, cessation of the discharge and clear urine in the two-glass test. To eliminate the possibility of latent gonorrhea, three prostatic massages at 2-day intervals were done 2 weeks after cessation of discharge. Following the occurrence of epididymitis after one such massage, three weeks were allowed to elapse before doing the massages in satisfactory cases and 4 weeks in unsatisfactory cases.

Cases were classified as "satisfactory" when there was remission of symptoms within 10 days and no complications had developed. Those cases in which the sulfa drug had to be continued beyond 10 days; those in which there were complications; or those in which there were relapses, were classed as "unsatisfactory".

Table 1 shows the course of 18 cases in which the results were considered unsatisfactory.

TABLE 1.—*Results of therapy "unsatisfactory"*

Case No.	Incubation period in days	Interval before therapy	Sulfathiazole days (dose)	Sulfapyridine days (dose)	Sulfadiazine days (dose)	Complications	Cured (days)
1	6	1	28 (gm. 112)	None	None	None	33
2	4	1	24 (gm. 96)	None	None	do	21
3	12	3	12 (gm. 48)	None	8 (gm. 48)	Hematuria	18
4	9	10	12 (gm. 48)	None	None	Recurrence of discharge	16
5	5	0	23 (gm. 110)	None	None	None	26
6	5	1	12 (gm. 72)	None	17 (gm. 102)	do	30
7	8	0	18 (gm. 72)	None	None	Recurrence of discharge; hematuria	20
8	4	0	1 (gm. 2)	None	None	Erythematous rash; edema face	35
9	11	2	10 (gm. 52)	1 (gm. 6)	27 (gm. 162)	Macular rash with pyridine; thiazole	39
10	3	1	10 (gm. 40)	None	24 (gm. 116)	Macular rash with both drugs; relapse.	[1] 53
11	?	2	26 (gm. 104)	None	None	Recurrence of discharge	52
12	2	0	21 (gm. 126)	8 (gm. 48)	None	do	[1] 36
13	10	2	12 (gm. 58)	None	None	Hematuria	49
14	12	1	7 (gm. 28)	4 (gm. 16)	None	do	63
15	[2]	0	12 (gm. 72)	None	None	Recurrence of discharge	[3]
16	7	5	24 (gm. 96)	None	None	Conjunctivitis	59
17	10	1	7 (gm. 28)	None	None	Epididymitis	8
18	5	8	14 (gm. 56)	7 (gm. 28)	None	Recurrence of discharge	25

[1] Not cured.
[2] Recurrence of discharge, 6 months.
[3] 6 months, 5 days.

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We present more briefly in table 2 the eight cases in which the results were considered satisfactory.

TABLE 2.—*Results of therapy "satisfactory"*

Case 19, discharge stopped in 2 days, admitted 1 day after onset of discharge.
Case 20, discharge stopped in 6 days, admitted 3 days after onset of discharge.
Case 21, discharge stopped in 3 days, admitted 1 day after onset of discharge.
Case 22, discharge stopped in 6 days, admitted 6 days after onset of discharge.
Case 23, discharge stopped in 5 days, admitted 10 days after onset of discharge.
Case 24, discharge stopped in 12 days, admitted 4 days after onset of discharge.
Case 25, discharge stopped in 9 days, admitted 9 days after onset of discharge.
Case 26, discharge stopped in 3 days, admitted 7 days after onset of discharge.

SUMMARY

Twenty-six patients with gonorrhea were treated with the sulfa drugs, chiefly sulfathiazole. In 18 of these, or approximately 70 percent, the results were not considered satisfactory; in 8 or approximately 30 percent, the results were considered satisfactory. In this series 1 patient required 12 days, and another 9 days of therapy before symptoms disappeared. In the 26 cases, there were 8 therapeutic complications including 4 instances of hematuria (microscopic), 3 cases of dermatitis, and 1 of conjunctivitis. There was 1 complication of gonorrheal epidiymitis. Posterior urethritis has not been considered as a complication, as it is usually considered part of the disease.

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NOTES ON OUR RESERVE CONTRIBUTORS

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Kaplan, Abraham, Lieutenant Commander (MC) USNR (*Cervical Spine Injuries*, p. 443). B. S., Harvard, 1923; M. D., Harvard Medical School, 1927. Associate neurosurgeon, Mount Sinai, Bellevue, Polyclinic Hospitals, Hospital for Joint Diseases, New York City. Member New York State Medical Society, American Medical Association, New York Neurological Society; diplomate National Board of Medical Examiners; fellow American College of Surgeons; diplomate American Board of Neurological Surgery.

Kolb, Lawrence C., Lieutenant (MC) USNR (*Duty Status Following an Induced Emotional State*, p. 438). B. A., Trinity College, Dublin University, 1932; M. D., School of Medicine, Johns Hopkins University, 1934. Intern, medicine and surgery, Strong Memorial Hospital, Rochester, N. Y., 1934–36; fellow, 1936–40; instructor in neurology, School of Medicine, Johns Hopkins Universtiy, 1940–41; assistant dispensary neurologist, Johns Hopkins Hospital, 1936–41; assistant visiting neurologist, Baltimore City Hospital, 1936–41; John and Mary Markle fellow in neurology, National Hospital, London, England, 1938–39; resident physciatrist, Milwaukee Sanitarium, 1941–42. Baltimore City Medical Society; Society of Neurological Physiology. Certified, American Board of Neurology and Psychiatry, 1941–42. Coauthor, Physiology of Micturition, Wm. Wood & Co., 1940.

Litterer, Ammon B., Lieutenant Commander (MC) USNR (*Study of Sulfathiazole in Calomel Ointment as a Prophylaxis for Gonorrhea*, p. 483). B. S., Peabody College for Teachers, 1922; M. D., Vanderbilt Medical School, 1923. Intern, pathology. Louisville General Hospital, 1923; dermatology and syphilology, New York Skin and Cancer Hospital, 1931; private practice, Nashville, Tenn., 1925, Miami, Fla., 1926; chief, dermatological staff Jackson Memorial Hospital, Miami, Fla., pathologist, Victoria Hospital, Miami, Fla. Member American Academy of Dermatology and Syphilology; American Therapeutic Society; Florida Dermatological Society; Florida State Society; Southern Medical Society; Dade County Medical Society; American Medical Association.

Lozner, Eugene L., Lieutenant (MC) USNR (*Suggestions on the Use of the Equipment of the Standard Army-Navy Package of Dried Plasma for Whole Blood Transfusions*, p. 451). M. D., Cornell University Medical School, 1937. Intern, Albany Hospital, 1937–38; assistant resident physician, 1938–39; resident physician, Thorndike Memorial Laboratory, Boston City Hospital, 1939–41; assistant in medicine, Harvard Medical School, 1939–41; associate in pathology, George Washington University Medical School, 1942–43. Member American Society for Clinical Investigation, American Federation for Clinical Research (Councilor 1941–48); American Association for the Advancement of Science. Coauthor, Hemophilia, Oxford Medicine 1941.

Master, Arthur M., Commander (MC) USNR (*Evaluation of Systolic Murmurs*, p. 307). B. S., College of the City of New York, 1916; M. D., Cornell, 1921. Cornell traveling fellow, University College Hospital Medical School, London, 1924–25; adjunct physician Mt. Sinai Hospital, New York, 1928–34; cardiographer, 1933, associate in medicine, 1934–41; electrocardiographer, clinic, medical college, Cornell, 1927–32. Cardiac consultant U. S. Veterans' Hospital No. 81, 1927–28; cardiologist Joint Disease Hospital, 1927–30; chief cardiac clinic, New York Hospital, 1928, assistant cardiographer, 1927–32, physician, outpatient department, 1933–41; assistant professor, clinical medicine, Columbia University, 1939–41. Member A. A.; American Medical Association; American College of Physicians; Society for Experimental Biology; Harvey Society; New York Academy of Medicine; New York Path. Society. Author, Elec-

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trocardiogram and X-ray Configuration of Heart, 2d edition, Lea & Febiger, Philadelphia, 1942.

McCarthy, Charles Lee, Commander (MC) USNR (*The Meatal Chancre*, p. 431). B. S., Princeton University, 1912; M. D., Johns Hopkins, 1916. Intern, Johns Hopkins Hospital, 1917. U. S. Naval Medical Corps, 1917–21. Postgraduate studies in dermatology and mycology: 2 years, University Berlin, Germany; 2 years Sorbonne, Paris. Private practice, Washington, D. C., 1925–42; formerly clinical professor, dermatology, Georgetown Medical School. Member American Dermatological Association; American Medical Association; corresponding member of French Dermatological Society; formerly president, International Medical Club; Society for Investigative Dermatology. Diplomate American Board of Dermatology. Author: Histopathology of Skin Diseases; Diagnosis and Treatment of Diseases of the Hair, C. V. Mosby Co., 1940.

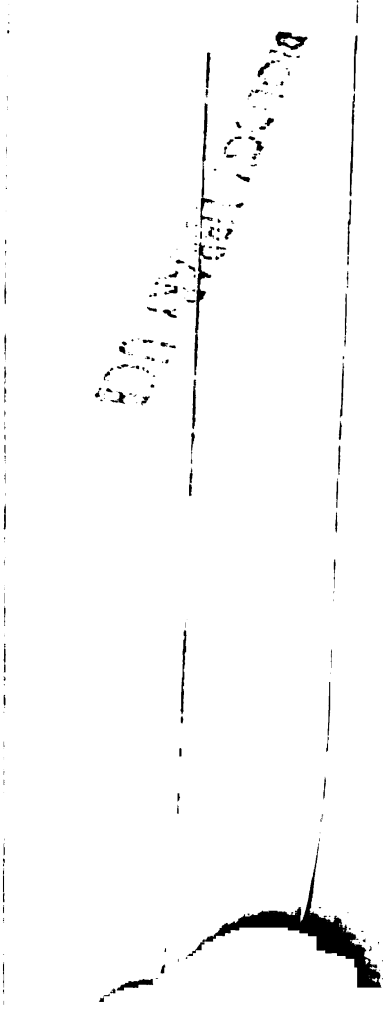
McLaughlin, Charles W., Jr., Lieutenant Commander (MC) USNR (*Traumatic Aneurysm of the Ulnar Artery*, p. 428). B. S., University of Iowa, 1927; M. D., Washington University School of Medicine, St. Louis, 1929. Resident in pathology, Montreal General Hospital, 1930–31; fellow in surgery, University of Pennsylvania Hospital, 1931–34; graduate study, Royal Infirmary, Edinburgh, Scotland, 1934–35; private practice, Omaha, 1935–; assistant professor surgery, University of Nebraska; surgeon, University of Nebraska Hospital, Nebraska Methodist Hospital and Bishop Clarkson Memorial Hospital, Omaha. Certified American Board of Surgery, Member Nebraska State Medical Society; American Medical Association; Central Surgical Association; American College of Surgeons; Western Surgical Association.

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O'Toole, John B., Jr., Lieutenant Commander (MC) USNR (*Celluloid Splint in Traumatic Amputation of Distal Phalanges*, p. 460). B. A., Holy Cross College, Worcester, Mass., 1927; M. D., Tufts College Medical School, Boston, 1932. Intern, St. Luke's Hospital, New Bedford, Mass., 1932–33; assistant in medicine, out-patient department, St. Luke's Hospital, 1933–35; chief of medicine, out-patient department, St. Luke's Hospital, 1935–39; assistant visiting house physician, St. Luke's Hospital, 1939–40. Fellow American Medical Association.

Pangburn, Edward W., Lieutenant Commander (MC) USNR (*Description of an All-Purpose Rigid Litter-Splint*, p. 456). B. S., Bucknell University, Lewisburg, Pa., 1915; M. D., University of Pennsylvania, 1920. Intern, Western Pennsylvania Hospital, Pittsburgh, 1921; resident physician, gynecology, Elizabeth



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Steel Magee Hospital, Pittsburgh, 1922; instructor in obstetrics, University of Pittsburgh, 1922; assistant surgeon, Northeastern Hospital, 1926–41; surgical staff of Frankford and Nazareth Hospital, Philadelphia; private practice, Philadelphia, 1923–. Member Philadelphia County Medical Association; American Medical Association.

Perlow, Samuel, Lieutenant Commander (MC) USNR (*Refrigeration Anesthesia in Leg Amputation,* p. 433). M. D., Northwestern University, 1927. Intern, Michael Reese Hospital, Chicago, 1927–29; instructor in anatomy and physiology, Northwestern University Dental School, 1928–35; associate in surgery, Northwestern University Medical School, 1935–42; adjunct attending surgeon and chief of vascular clinics, Michael Reese Hospital, 1933–42; associate attending surgeon, Cook County Hospital. Fellow American Medical Association; fellow American College of Surgeons; diplomate American Board of Surgery.

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Rakov, Harold L., Lieutenant Commander (MC) USNR (*Paroxysmal Cardiac Pain,* p. 316). B. S., Syracuse University, 1923; M. D., Syracuse University School of Medicine, 1925. Intern, New York City Hospital, 1925–27; resident, New York Cancer Hospital, 1927–28; private practice, Kingston, N. Y., 1928–; attending cardiologist, Kingston Hospital; Ulster County Tuberculosis Hospital; Veterans Memorial Hospital, Ellenville, N. Y. Fellow American College of Physicians; Member American Medical Association; New York State Medical Society; Ulster County Medical Society (president 1939); American Heart Association; New York Heart Association.

Scala, Charles J., Lieutenant, junior grade (MC) USNR (*Evaluation of Sulfathiazole in the Treatment of Gonorrhea,* p. 489). B. S., College of the City of New York, 1933; M. D., New York Medical College, 1937. Intern, clinical assistant visiting physician, Fordham Hospital, 1938–42; private practice, Bronx, N. Y. Member Bronx County Medical Society; American Medical Association.

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States Dermatological Society; Society for Investigative Dermatology; Pittsburgh Dermatological Society. Certified American Board of Dermatology and Syphilology, 1940.

Sher, Joseph J., Lieutenant Commander (MC) USNR (*X-ray Treatment of Pilonidal Cysts*, p. 391). M. D., Long Island College of Medicine, Brooklyn, N. Y., 1929. Formerly with Department of Health, New York City (for 10 years) and U. S. Veterans' Administration, 1935–37; private practice in Brooklyn, N. Y. Diplomate American College of Radiology.

Steen, Reginald R., Lieutenant Commander (MC) USNR (*Effort Syndrome an Anxiety State; A Plea for the Elimination of Misnomers*, p. 353). B. S., University of Wisconsin, 1925; M. D., Harvard Medical School, 1927. Intern, pediatrics, Presbyterian Hospital, New York City, 1928; psychiatrist, Kings Park State Hospital, Kings Park, N. Y., 1929–34; medical inspector, New York State Department of Mental Hygiene, 1934–40; first assistant physician, Kings Park State Hospital, 1940–42; director of the parole and family care subcommittee of the New York State Governors Committee on State hospital problems, 1942–. Member of American Medical Association; American Psychiatric Association; diplomate American Board of Neurology and Psychiatry.

Stubenbord, John G., 3d, Lieutenant Commander (MC) USNR (*Lumbar Hernia Through the Triangle of Petit*, p. 381). A. B., Columbia College, 1924; M. D., Cornell University Medical School, 1927. Intern: Reconstruction Unit, Postgraduate Hospital, 1926–27, Memorial Hospital For Cancer and Allied Diseases, 1927, New York Hospital, 1928–30; private practice, Douglaston, New York, 1930; assistant attending surgeon, dispensary Flushing Hospital, 1930–39; assistant surgeon, Mary Immaculate Hospital, 1931; clinical assistant visiting surgeon, Queens General Hospital, 1935. Member American Medical Association, Medical Society of County of Queens, New York; diplomate National Board of Medical Examiners.

Swan, Channing S., Lieutenant Commander (MC) USNR (*Observations on the Ambulatory Treatment of Gonorrhea*, p. 485). M. D., Harvard, 1923. Intern, Massachusetts General Hospital, 1923–25; Johns Hopkins Hospital, Baltimore, 1925–26; certified 1937. Fellow American College of Surgeons; member American Medical Association; American Urological Association.

Teed, R. Wallace, Lieutenant Commander (MC) USNR (*Factors Producing Obstruction of Auditory Tube in Submarine Personnel*, p. 293). A. B., University of Michigan, 1924; M. D., University of Michigan, 1927. Intern, Packer Hospital and Guthrie Clinic, Sayre, Pa., 1927–28; general practice, Owosso, Mich., 1928–32; resident in otolaryngology, University of Iowa, 1932–34; private practice in Ann Arbor, Mich., 1934–. Member American Academy of Ophthalmology and Otolaryngology; Detroit Otolaryngological Society; Southern Michigan Triological Society; licentiate American Board of Otolaryngology; fellow American College of Surgeons.

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Woldman, Victor F., Lieutenant Commander (MC) USNR (*Vermiform Appendix in Inguinal Hernial Sac.*, p. 440). A. B., Adelbert College, 1925; M. D., Western Reserve University, 1928. Postgraduate work, University of Vienna, 1933. Intern, Mt. Sinai Hospital, Cleveland, Ohio, 1928–29. Department of gynecology, Mount Sinai Hospital, Cleveland; Chief of staff, Mary B. Talbert Hospital, Cleveland. Member American Medical Association; Ohio State Medical Association; diplomate American Board of Obstetrics and Gynecology.



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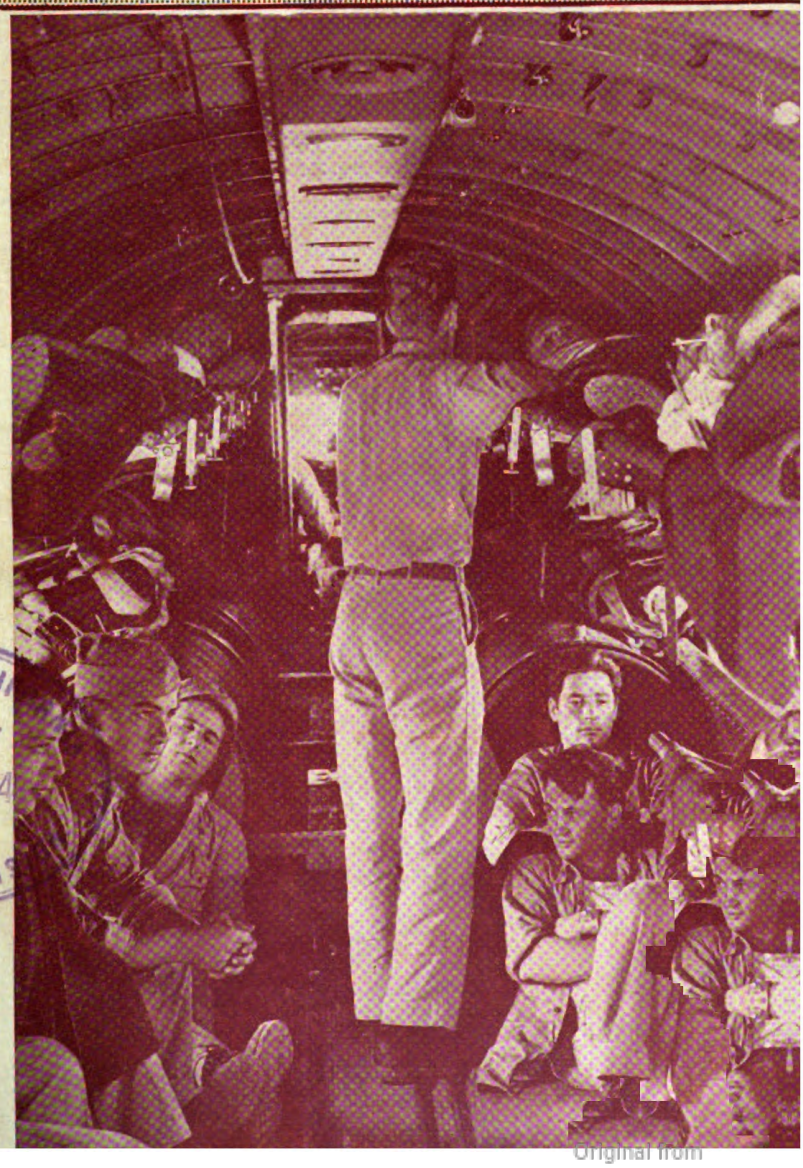
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COVER PHOTOGRAPH

Forward view within the cabin of an ambulance plane of South Pacific Combat Air Transport. The patients, both ambulatory and stretcher cases, are being flown from a combat area in the South Pacific to a Naval base hospital several hundred miles to the rear. Note auxiliary gasoline tanks forward.

—Official U. S. Marine Corps Photo.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Contributions to the BULLETIN should be typewritten, double spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have them typewritten.

In submitting articles for publication the author should include a signed statement to the effect that "the opinions or assertions contained therein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large." (Art. 113 (2) U. S. Navy Regulations.)

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The BULLETIN intends to print only original articles, translations, reviews, and reports and notices of Government or departmental activities, official announcements, etc. All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short. A lengthy, otherwise excellent article will very often lose readers, appalled by its mass.

The editor regrets to have to say that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANSDELL, *Editor*,
Commander, Medical Corps,
United States Naval Reserve.
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U. S. NAVAL MEDICAL BULLETIN

VOL. XLII MARCH 1944 No. 3

SPECIAL ARTICLES

OXYGEN EQUIPMENT IN THE AMBULANCE PLANE

JUSTIFICATION FOR ITS USE

H. HOFFMAN GROSKLOSS
Lieutenant Commander (MC) U. S. N. R.
and
F. KIRK SMITH
Commander (MC) U. S. N.

Each flight surgeon connected with a primary training base is accident-conscious and this consciousness is inescapably fused with such corollaries as head injury and shock, both primary and secondary. It is his necessary and willing obligation to institute shock therapy as early and as completely as is practical in order that every possible aid may be given the patient to insure his eventual recovery. With ever increasing numbers of outlying fields constantly being employed and with growing cross-country activities, exigencies causing delay, both in reaching the patient and transporting him to the station hospital, are becoming more threatening. The equipment now installed in the ambulance plane is designed to meet the essential treatments to be outlined subsequently.

Traumatic shock, especially that resulting from head injury, has as one of its closely related attending phenomena a true anoxia. Such phenomena are manifested by a capillary circulatory failure; a fall in blood pressure with a decrease in volume and rate of blood flow through the capillary system; a decrease in cerebral oxygen consumption and cerebral blood flow; and a state of relative to absolute anoxia. Anoxia is important in respect to the development and the augmentation of traumatic shock. The vital centers of the brain, already embarrassed by the effects of direct trauma in cases of head injury, are said to share in the anoxic state; and, through known reflex mechanism due to sensitivity of oxygen lack or variations in carbon dioxide tensions in the blood, the respiratory center gives vent to a disturbance in the rate and depth of respirations, further encouraging an anoxic anoxemia.

Schnedorf et al. (*14*) have reported depressions of arterial blood oxygen saturation from 5 to 44 percent below normal in 9 dogs and 12

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patients with head injuries. Oxygen therapy restored the blood oxygen saturation to and above normal. It also caused a 70-percent increase in the length of life of dogs in traumatic shock, a 71-percent increase in duration of life in dogs in histamine shock, and 17-percent increase in length of life of dogs in shock resulting from hemorrhage. In addition, the latter, which were given oxygen, withstood the loss of larger volumes of blood. Its use should be continued when an anesthesia known to produce mild or severe anoxic states is needed. Oxygen therapy is indicated long before cyanosis is present or long after it has disappeared. More important still are the anoxic degenerative changes in cerebral tissue cells which have been demonstrated by these and other authors. They also revealed a decrease in the oxygen content and saturation of the blood from the femoral artery and vein in nembutalized dogs in traumatic shock. Oxygen therapy again markedly increased the oxygen content in the arterial and venous blood. An elevation of arterial blood pressure resulted with the giving of oxygen. Also noted was a depression of capillary tone and pressor reflex activity of the carotid sinus. This activity was restored with the administration of oxygen. Peripheral circulatory failure due to histamine is definitely benefited.

Bohr et al. (*3*) stressed the fact that an increase in carbon dioxide tension results in a greater oxygen dissociation from oxyhemoglobin.

Boothby, Mayo, and Lovelace (*4*) have shown that in anoxic states 80 percent instead of 40 percent of the oxygen passes slowly through the capillaries. The venous blood is 20-percent saturated instead of the normal 60 percent. This may be raised again to 33 percent on the administration of oxygen. There is a corresponding increase in partial pressure of oxygen in the capillaries from 14 to 21 millimeters. This is the equivalent of a 50-percent increase in the pressure of oxygen in the tissues. They also added that oxygen therapy not only results in an increase in oxygen in chemical combination with hemoglobin but in the amounts in physical solution in the blood plasma.

Landis (*8*) lent some support to instituting oxygen therapy early when he showed that aborting the anoxemic state allowed for reversible changes in capillary permeability, whereas if the anoxia were prolonged the changes became irreversible.

Moon (*11*) suggested that capillary circulatory failure results from a disparity between the volume of the blood and the volume capacity of the vascular system. This in turn results from the reciprocal effects of capillary atony and tissue anoxia, thus tending to irreversible conditions. Early studies reveal a definite hemoconcentration.

Lindquist and LeRoy (*9*) ingeniously noted that within 1 hour after trauma sufficient to cause contusion of the brain in dogs there was an average decrease of 24 percent in cerebral oxygen consumption, and

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of 17 percent in cerebral blood flow. The administration of 50-percent glucose or sucrose presented a significant elevation of oxygen consumption. Cerebrospinal fluid drainage also permitted an increase in oxygen consumption and cranial blood flow. They concluded that the cerebral blood flow following head injury is affected relatively little by treatment whereas cerebral oxygen consumption is strikingly increased. The oxygen consumption of the brain is not dependent on blood flow alone or on arterial oxygen alone. The metabolism of nerve tissue and its ability to utilize oxygen is directly affected by head injury. They also suggested that such a mechanism could serve to explain the phenomenon of concussion. Since hypertonic solutions and spinal fluid drainage increase brain consumption of oxygen one might rationally resort to their employment.

Yesinick and Gellhorn (*22*) in their studies on increased intracranial pressure and its effects during anoxia and hypoglycemia, revealed that the inhalation of 7- to 8-percent oxygen potentiates the blood pressure response to raised intracranial pressure in the anesthetized dog. They state that this increases with increased duration of the period of anoxia. This potentiation was shown to persist in the absence of the buffer nerves. Hypoglycemia also potentiates the blood pressure response to raised intracranial pressure. The effect increases progressively with a falling blood sugar. Either condition is reversible with inhalation of air and the giving of glucose. It would seem, therefore, that beneficial effects would in such wise follow in respect to oxygen consumption in cases of increasing intracranial pressure.

Gellhorn and Lambert have also suggested a deleterious effect of anoxemia on the carotid sinus. This may explain the immediate improvement, in part at least, of the blood pressure and pulse with oxygen therapy.

Moon noted the remote effects of capillary permeability and tone alterations. Petechiae may result finally. Blalock and Bradburn (*2*) point out a local loss of body fluids into and near the traumatized area. The brain undoubtedly shares in this mechanism and may account for focal signs and those of increasing intracranial pressure. Landis aptly described the deleterious effect of anoxia on capillary wall permeability to fluids and plasma proteins in his microinjection studies.

Wood, Mason, and Blalock (*21*) offered, as a response to oxygen therapy in experimental shock, an increase in cardiac output, a decrease in the pulse rate, an increase in rate and depth of respiration and an increase in the oxygen content of both the arterial and venous blood.

Cusick, Benson, and Boothby (*6*) have discussed favorably the effect of anoxia and of high concentrations of oxygen on the retinal vessels. Their work also confirmed the observation of Tinel (*20*) on the contraction of cerebral vessels.

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Degenerative changes in the adrenals, the medulla, and the cortex alike, have been demonstrated.

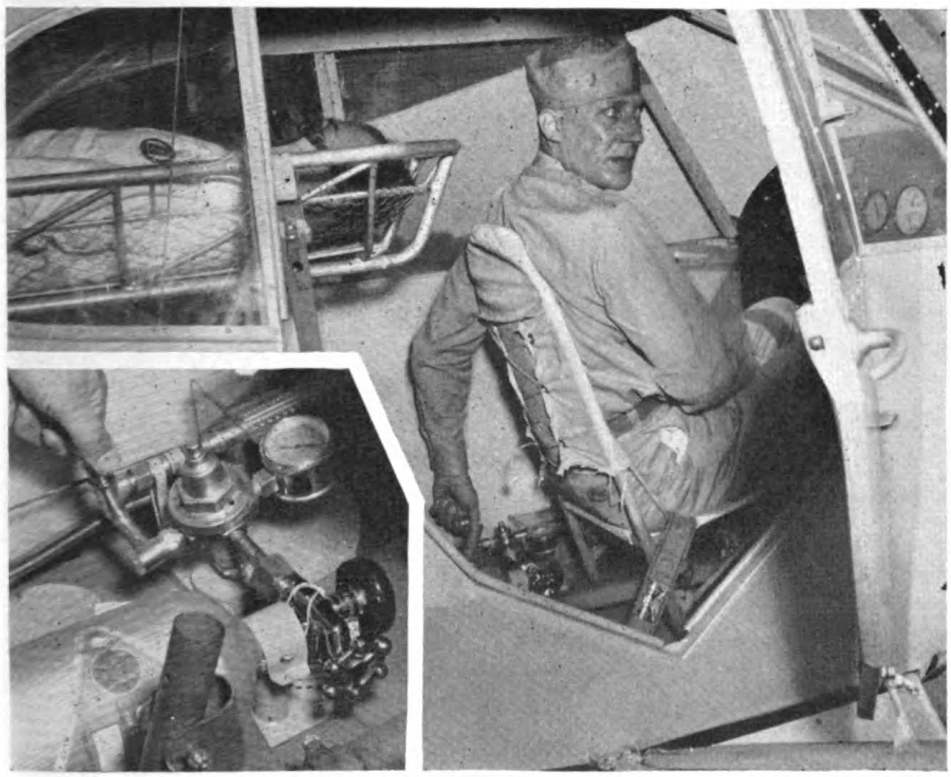
Boothby, Mayo, and Lovelace have suggested that the giving of oxygen is most efficacious when the reduction of the blood volume has ceased and is least beneficial in shock associated with continued decrease in the blood volume. Cressman and Blalock (*5*) add that it would seem logical to use oxygen inhalations in the treatment of traumatic shock, at least until the blood volume could be restored, to carry the patient over a critical period.

Introducing the influence of altitude and oxygen deprivation of relative degrees, Lovelace (*10*) summarizes various clinical states and the importance of the administration of oxygen. There is a slight rise in spinal fluid pressure among normal subjects. It follows, therefore, that increasing altitudes might effect an aggravation of symptoms of certain types of intracranial pressures thus encouraging the possibly already increasing intracranial pressure present. Other conditions demanding the use of oxygen are cardiac disorders, anemias, infections, artificial or traumatic pneumothorax, high sulfa drug concentrations. Obviously, increased intestinal pressures noted in higher altitudes should be avoided in cases of intestinal perforations and because of the danger of disseminating infection.

In observing closely the course of pilots suffering from multiple severe traumata in whom head injury is paramount, one may observe progressively primary and secondary shock, increasing intracranial pressure, a period of improvement, relapse, with increasing coma and death. There appears to be one factor, as may be adduced from the foregoing discussions, that may prove important to any of these phases and this factor is oxygen. Schreiber (*17*) approaches the problem of rational therapy by dividing anoxia into five mechanisms: Anoxic anoxia (oxygen pressure low); anemic anoxia (too few oxygen carriers); stagnant anoxia (circulation of oxygen too slow); histotoxic anoxia (oxygen not utilized by cerebral cells because of effect of extrinsic agents); neurohumeral anoxia (oxygen not utilized by cerebral cells because relations and proportions of normal cell components are disturbed). One may readily see that oxygen is essential to meeting all these conditions. In one instance blood may be needed to serve as a carrier of oxygen. All obstructions to the airway must be removed (tongue, mucus, blood, etc.). Other routine shock measures must be employed. The recent trend of the use of cold in place of heat is quite deserving of mention here. We have witnessed the miraculous recovery of one of our cadets who lay in the snow, his calvarium revealing 13 fractures (including those of the frontal, malar and mandibular bones, and the anterior and middle fossae), for 45 minutes, in shock and in coma. The temperature was 10 degrees below zero.

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Many patients with less serious head injuries have been observed since then who failed to survive the accident. Localized space-displacing lesions (extradural hemorrhage, subdural hematomas and hydromas) may show a rapid descent in the anoxic scale with homolateral enlargement of pupil and frequently a fracture over site of middle meningeal artery. Depressed skull fracture fragments may have to be elevated. Unlocalized increased intracranial pressure should be treated with cautious cerebral spinal fluid drainage (as shown above oxygen consumption may be enhanced also in this manner), repeated daily



1. Showing installation of oxygen equipment on ambulance plane, with accessibility of control by pilot.

if necessary. Refrigeration is indicated with gradual increase of environmental temperature.

Vigilance is the next most important factor, especially as to the specific mechanism of anoxia present at the time of observations. Schreiber reminds us that pulse and respirations are usually rapid with brain stem injuries and slow with increasing intracranial pressure. Pupils which are pin point are often associated with brain stem disintegration. Unequal pupils are often valuable signs of space-displacing lesions, the enlarged pupil usually being on the side of the lesion. No attempt should be made to examine or clean

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an ear which is draining blood or cerebrospinal fluid. Deep and superficial reflexes, pupillary and fundoscopic findings should be recorded. Changes in these signs are of extreme diagnostic value. X-ray studies of the skull should be delayed until the patient is cooperative. Schreiber warns us that early prognosis is hazardous. The reasons are obvious. Prognosis is better if there is no respiratory difficulty present. Signs of meningitis usually do not appear until the end of the first week.

In summary, therefore, oxygen therapy with aids in its utilization such as transfusions with whole blood (given slowly), plasma, glucose, repeated spinal fluid drainages (caution should be observed in cases of basal skull fractures where there is drainage of cerebrospinal fluid), plays a paramount role in the treatment of craniocerebral injuries. There is reason to feel that adrenal cortical hormone is also of value in the treatment of shock.

Lamson of Vanderbilt University, in studying the cellular oxidative enzyme systems in shock, speaks of a breakdown of diphosphothiamine. The administration of thiamine seems to increase the threshold of resistance against shock due to blood loss. It would seem, therefore, indicated in instances of shock secondary to hemorrhage of any moment.

The oxygen equipment herein described and illustrated is simple of application and is being used in our cub ambulance planes. It consists, as one may observe, of a small oxygen model D tank, a B. L. B. mask, the model D inhalation apparatus with regulator, a flow meter, an oronasal mask, and a pin needle yoke as an aid to the regulation of oxygen flow. The approximate weight of the entire equipment is only 18 pounds. Enough oxygen is available, if the flow is set at 5 liters per minute, to cover the transportation of any of the training plane accident subjects back to the station hospital. The earliest possible institution of oxygen therapy cannot be questioned. The patient may be treated at the scene of the crash, the rate of flow established (after the airway is insured against any obstruction), and the pilot instructed to remove the mask and airway if the patient vomits or begins to react.

We wish to acknowledge the encouragement and helpful suggestions offered by Dr. Walter M. Boothby, and the cooperation of the A. & R. Department of this station for their aid in installing the equipment.

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MEDICAL COMPLAINTS OF FLYING PERSONNEL

AT A NAVAL AIR STATION

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Aviation medicine is becoming increasingly difficult to define. It is not a medical specialty in the ordinary meaning of this term, but comprises a broad field of which clinical medicine is only a part. Any attempt to define more closely the clinical aspects compels a careful analysis of the duties aviation medical officers will be called upon to perform. To make such an analysis in the United States Navy seems not only worth while but necessary. Only in this way can all of the important problems be ascertained, and only after this information is obtained, can the proper selection of personnel be made or appropriate graduate instruction be given.

Much attention has already been given to the duties and problems involved in the selection of aviators and the criteria used in this selection have been carefully defined. There is great interest also in the care and maintenance of aviators in combat areas, although it may be said in passing that our knowledge in this regard is far from complete. However there has been much less interest shown in the nature and scope of the medical problems associated with the period of flight training. Nevertheless these problems are important for three reasons: (1) Because of their direct bearing on the health and efficiency of aviation cadets and instructors; (2) because they may serve as a partial check on the criteria and methods employed in the original selection of pilots; and (3) because they may anticipate some of the problems arising in the field. Accordingly an analysis of the medical complaints of all flying personnel over a 6-month period at this Naval Air Training Center was undertaken.

MATERIAL AND METHODS

Data for the present study was obtained from the medical logs at the several dispensaries. The only information available was the chief complaint or diagnosis, nature of the treatment, and, in most instances, the disposition of the case.

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The period from February to August was selected because it covered a representative half of the year with respect to the weather, the first 2 months being cool, the next 2 temperate, and the last 2 hot and humid. The number of flying personnel averaged 2,240 with little monthly variation; approximately three-fourths of this number were students and one-fourth instructors.

In addition to the dispensary at the main station there were several smaller dispensaries nearby at Fields A, B, and C which were used principally for emergency cases until the last 2 months of the period under consideration, when their scope was extended. However because most of the flying personnel at the outlying fields were quartered at the main station, the dispensary there was available to nearly everyone. This led to double entries in the log when on occasion a patient might report to one of the outlying dispensaries during the day and the main dispensary at night.

Because of striking differences in the incidence of certain complaints at the different fields it should also be mentioned that at the main station both primary and more advanced instruction was given; at A Field primary instruction only; at B Field slightly advanced instruction, including acrobatics; and at C Field, moderately advanced instruction, chiefly in formation flying.

RESULTS

During the 6-month period under analysis 15,859 separate complaints[1] were made in a group of approximately 2,240 men. This represents an average of 7 complaints for each pilot, or over 1 complaint per month. The frequency distribution of the major complaints is shown in figure 1 from which it is seen that nearly four-fifths were the result of respiratory and superficial infections.

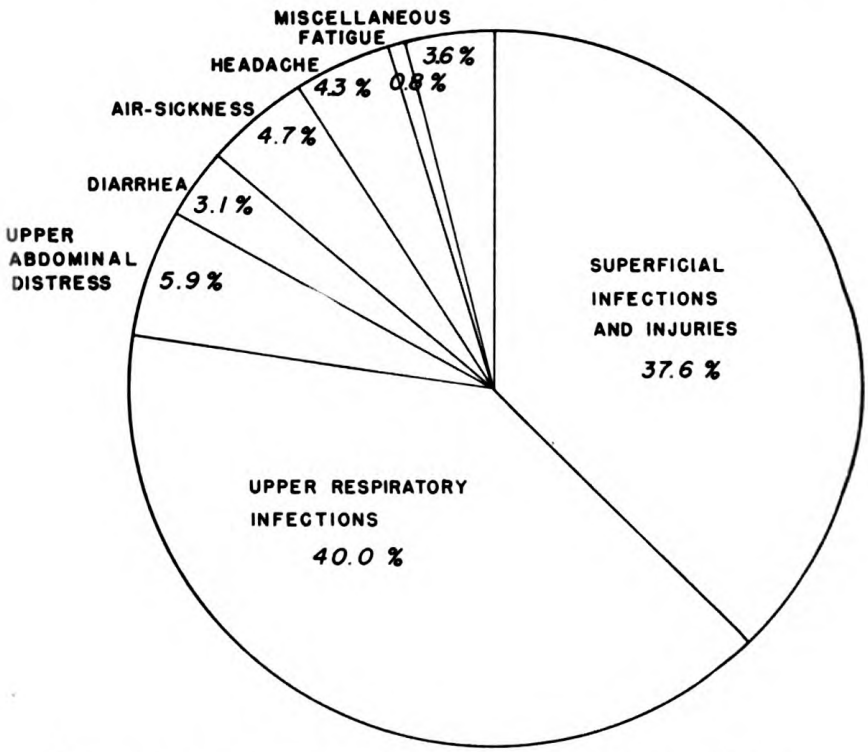
The seasonal variation with respect to the complaints is shown in figure 2. With the exception of coughs and colds, the incidence of all complaints was greater in the hot than in the cool months.

The variation in the frequency distribution of the chief complaints with respect to the different flying fields is shown in figure 3. In line with the findings shown in figure 2, only the complaints during June and July are included. Three striking features deserve special comment. The first is the relatively high frequency of most complaints at the main station. This is undoubtedly due, as previously mentioned, to the fact that many of the aviators flying at the outlying fields were quartered at the main station and often used the dispensary there.

[1] The actual number of visits was greater, as the same person may have visited the clinic several times for the same complaint.

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The second feature is the surprisingly small number of complaints of any kind at C Field. This was not due to differences in the medical facilities or medical policy but to factors concerned with the type of flying, the stage of training, selection, and motivation. The student aviators at C Field had all had several months' training and those not adapted to flying for various reasons had dropped out or been eliminated. There were no aerobatics and hence little occasion for airsickness. Morale and motivation for flying were extremely good. But these factors could scarcely affect conditions such as the incidence of food poisoning or fungus infection. Obviously some-



1. Showing the incidence of the various groups of complaints.

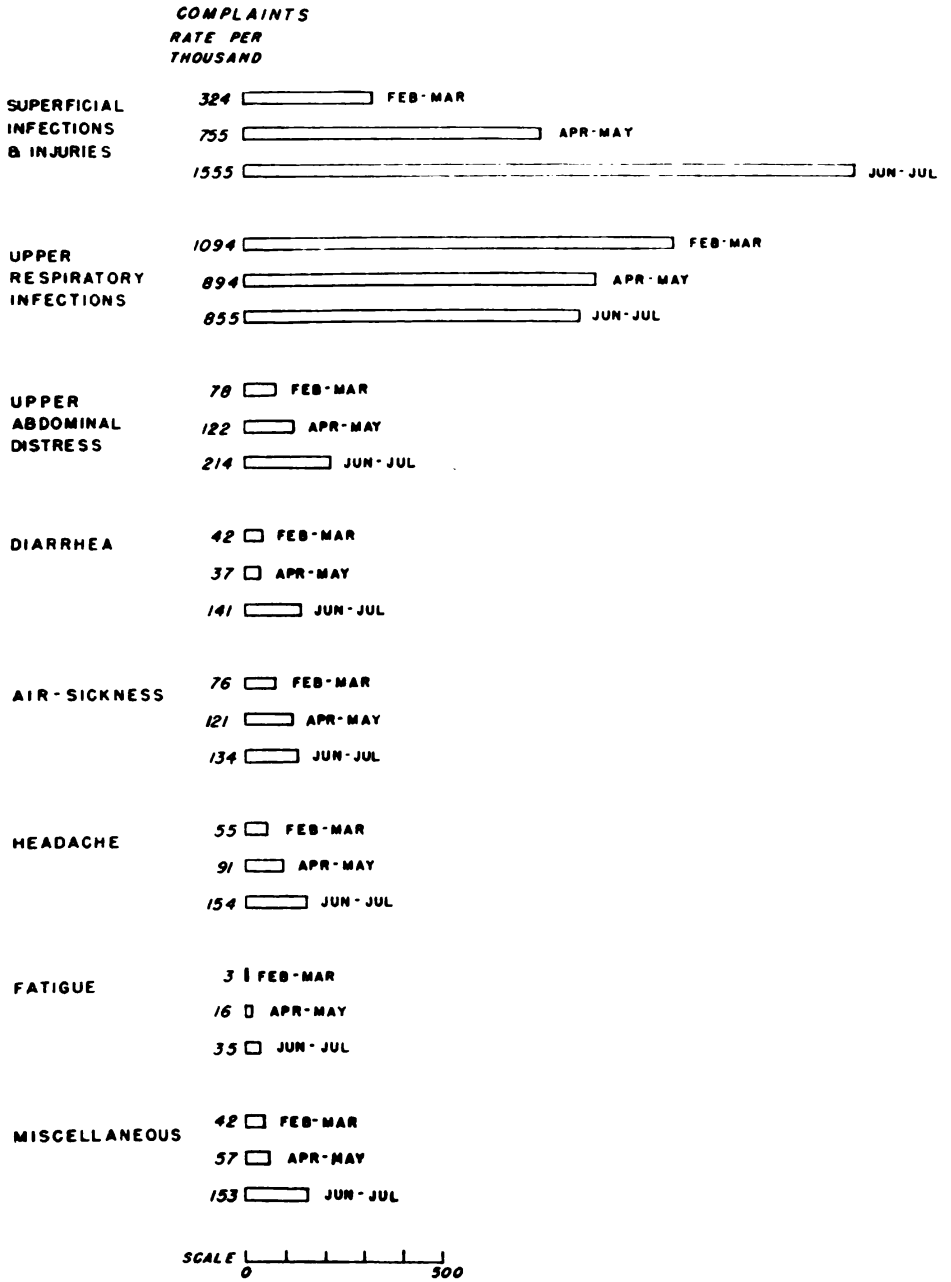
thing more was responsible. It is our opinion that by the time they reached C Field the men simply did not go to the dispensary with their minor complaints. They flew despite a cold or headache which would have sent them to the dispensary at an earlier period of their indoctrination.

The third feature deserving comment is the high incidence of airsickness at A and B Fields. It is thought that this was due to the fact that airsickness is observed fairly commonly in primary squadrons such as were at A Field, or in more advanced squadrons doing aerobatics at B Field. Primary training formed only a small part of the flying at the main station and none at C Field.

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UPPER RESPIRATORY INFECTIONS.

The common cold, sore throat, sinusitis, catarrhal fever, or grippe comprised the largest group of the complaints, numbering 6,356. Although only a few of those afflicted required hospitalization, nevertheless, it was necessary to excuse the majority from flying for at least 1 day. Respiratory infections were thus responsible for loss of more flying time than all other diseases combined.



2. Showing the seasonal incidence of complaints.

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The small seasonal variation in the incidence of respiratory infections in flyers (fig. 2) contrasts sharply with that observed in non-flying personnel and requires explanation. The pilots themselves attribute the high incidence of colds in summer to the fact that they are warm while on the ground and quickly become cool on going aloft. It is reasonable to presume that frequent changes of this sort might be the principal factor. Other factors which may tend to level out



3. Showing the difference in incidence of the several complaints at the various fields.

the seasonal incidence are: (1) The fact that an aviator may complain of a "cold" when, for any reason, there is obstruction of the eustachian tubes or the openings into the sinuses; and (2) the fact that in the heat of summer the general health of the aviator, as judged by the increased incidence of all other complaints, is less good.

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SUPERFICIAL INFECTIONS AND MINOR INJURIES.

Various skin disorders, minor injuries, and superficial infections comprised the second largest group of complaints numbering 5,960, or 37.6 percent of the total. The four-fold increase (fig. 2) during the hot months is striking, and is largely due to the increased prevalence of fungus infection and miliaria. A slightly more detailed analysis at B and C Fields shows that of 901 complaints, 357 were for fungus infection, 150 for various skin disorders other than fungus infection but chiefly miliaria, 143 were for superficial infections, chiefly boils, 182 were for minor injuries, and 69 were for miscellaneous causes.

Fungus infection.—This constitutes an important problem during the hot, humid summer months, as only a few persons escape infection. The feet, scrotum, and groin are the areas most commonly involved. Although it was rarely necessary to excuse a pilot from flying because of fungus infection, yet the annoyance was frequently sufficient to reduce working efficiency. Itching, inability to exercise, loss of sleep, and secondary infection all contribute to the discomfort. Treatment was not very successful and recurrences were frequent.

Miliaria.—So-called heat rash was also a very common complaint during the summer, but is a much less important cause of discomfort and annoyance than fungus infection.

Superficial infections.—The large majority of these complaints were caused by pus-forming organisms. Although many of these were of a minor nature, occasionally they were responsible for loss of flying time.

Minor injuries.—Sprains, blisters, lacerations, and other injuries were common complaints and were responsible for a considerable loss of flying time. Most of the injuries resulted from the various athletic activities; only a few were caused by airplane crashes and parachute descents.

GASTRO-INTESTINAL COMPLAINTS.

Gastro-intestinal complaints were classified under two main headings: (1) Abdominal distress without diarrhea; and (2) diarrhea.

Upper gastro-intestinal complaints.—There were 933 instances of indigestion, sick stomach, nausea, acute or chronic gastritis, and the like Some were undoubtedly airsickness cases, some were probably mild food poisoning cases without diarrhea; and still others were the result of overindulgence in food and alcohol. Pilots with these complaints were usually excused from flying for at least 1 day. There was a significant increase in the frequency of these complaints during the hot weather.

Diarrhea.—Of 495 cases of acute diarrhea, practically all were regarded as instances of food poisoning. This opinion was supported

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by the striking increase in incidence during the summer and by the clinical picture. The onset was abrupt, with abdominal cramps, watery diarrhea, nausea and sometimes vomiting. The generalized reaction was slight, and in most instances only a single day was lost.

AIRSICKNESS.

There were 745 complaints of airsickness. The actual incidence was probably greater because slight attacks were not reported, because some of the cases diagnosed "indigestion" were probably airsickness cases, and because some pilots hesitated to acknowledge airsickness and made other complaints when reporting at the dispensary. Usually the airsick aviator complained of general malaise, nausea or a feeling of epigastric distress, fatigue and occasionally headache. It should be emphasized that a considerable degree of airsickness may be present without vomiting.

The number of pilots visiting the clinic because of airsickness varied greatly. At B Field, for example, 2 or 3 days might elapse when no cases were observed, while at other times relatively large numbers were seen. Several factors may have been responsible for this variation, such as the arrival of a new group of students, the particular maneuvers carried out, and possibly weather conditions.

It is interesting that there were no cases of airsickness at C Field, relatively few at the main station and relatively large numbers at B and A Fields. In other words, many pilots in the early stages of training, and especially during aerobatics, complained of airsickness, whereas few pilots in the advanced squadrons complained. The reasons for the absence of airsickness complaints at C Field were thought to be that: (1) Some of the most susceptible individuals had been eliminated; (2) the formation flying taught at this field did not include combat maneuvers or aerobatics; (3) the more advanced pilots, apparently because of their greater interest in flying and more thorough indoctrination, seemed to complain less.

HEADACHE.

Headache is an extraordinarily common complaint among pilots, and accounted for 677, or 4.3 percent of all illness in our series. It should be explained that headache usually accompanies the acute fatigue experienced by pilots. Many of the flight officers did not consider fatigue an acceptable reason for excusing a student pilot from flying, and headache therefore was used as the chief complaint despite the fact that fatigue was the more important. But other causes of headache were observed, including sun glare, the effects of acceleration, and aerosinusitis. That the last-named is actually one of the

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causes of headache is demonstrated by the marked relief obtained following the use of nasal sprays containing a vasoconstricting agent.

FATIGUE.

Fatigue was apparently not a very common complaint, occurring in only 125 instances, or 0.8 percent. For the reasons previously stated, it is thought that the actual incidence is somewhat greater, and a separate study is being made. The treatment usually suggested was a day's rest. There was a striking increase (fig. 2) in the number of cases in the hot summer months, but the total number of cases is too small to prove this conclusively.

MISCELLANEOUS COMPLAINTS.

There were 568 complaints representing a wide variety of disorders. Some of these require special mention:

Cardiovascular.—There were four complaints of dizziness which may or may not have been due to peripheral circulatory failure. Five pilots complained of "pain around the heart," none of whom had organic heart disease. There was one instance of sinus tachycardia and one case of pleural and pericardial effusion. The patient with the effusions was studied over a long period in the hospital and was thought to have had acute rheumatic fever.

Eye.—At B and C Fields, of a total of 2,689 complaints 70 were referable to the eye. Injuries, foreign bodies, and infections were the three types of disorders seen. Gasoline in the eye was the complaint in 14 cases.

Ear.—At B and C Fields there were 49 complaints referable to the ears. Aero-otitis media, and fungus infection of the external canal were the most common disorders.

Neuropsychiatric disorders and problems.—Only 10 entries in the log could definitely be listed under this heading. These included 5 cases of "nervousness," 3 of neurosis, and 1 each of anxiety neurosis and psychoneurosis. A much larger number of cases was actually observed, but either the visit was regarded as confidential and no entry made, or some indefinite term was used. This policy was justified on the grounds that no opinion should be recorded of any psychiatric disorder until it had been proved to be such, and also that pilots would be more likely to come to us with their problems if the visit would be "off the record."

An attempt was made to gain some idea of the frequency of such "off the record" visits. The medical officers in charge of the several dispensaries estimated that during the 6-month period there were approximately 150 instances in which various personal problems or disorders of personality constituted the chief complaint. Some of

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these cases were referred to the psychiatric department, and, although they were not kept in a separate category, an idea of their nature can be gained from an analysis of the records of this department. In a period of 1 year 850 new cases of record were of flying personnel, 286 of which were referred from the various dispensaries, and from the aviation examining room. They included:

68 cases of anxiety, anxiety neurosis, or psychoneurosis.
18 cases of emotional instability.
4 cases of conversion hysteria.
6 cases of cyclothymic personality.
3 cases of schizothymic personality.
2 cases of mental depression.
2 cases of schizophrenia.
1 case of post-traumatic personality disorder.
2 cases of syncopal attacks of doubtful etiology.
2 cases of chronic alcoholism.
1 case of acute phenobarbital intoxication.
4 cases of organic neurologic conditions.
65 cases in which the student expressed a desire to resign from flight instruction.
31 cases of various psychosomatic disorders.
17 cases in which there was no disorder of any kind.
60 cases of miscellaneous types.

The remaining 564 cases were referred because of flying difficulties, and preliminary to a review by a board of officers who pass on the fitness of the student to continue his flight training. A study of these cases revealed that the great majority were troubled with problems well within the province of the flight surgeon.

It may be safely concluded, therefore, that psychologic and neuropsychiatric complaints and conditions are many times more numerous than an analysis of the medical logs in the dispensaries would indicate. Taken together they form not only the most important cause of loss or dismissal of flight personnel, but exceed in this respect all other causes combined. The stresses and strains involved in present day military aviation, even in the instruction stage, serve to uncover defects and aberrations of personality which, under less arduous circumstance, would not appear. It is likewise evident that more needs to be accomplished in bringing the aviator and flight surgeon into closer relationship, because only a small percentage of the known problems first came to the attention of the flight surgeon.

The remainder of the miscellaneous group comprises many different disorders, including measles, mumps, gonorrhea (2 cases), reaction to various vaccines, insect bites, sunburn, chemical and other burns, appendicitis, fractures, toothache. There still remained nearly 250 complaints which were too vague or uncertain to classify.

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SUMMARY

The complaints of flying personnel recorded in the medical logs t the several dispensaries were analyzed for the period 1 February o 1 August 1942. During this time both primary and intermediate ying training were in progress. The average enrollment of students nd instructors was 2,240, and 15,859 separate complaints were logged. epeated visits for the same complaint were not counted. Thus each erson, on the average, had over 1 complaint per month.

The great majority of the complaints resembled those seen in ndustrial medical practice. Although most of the complaints were ot of a serious character, they were responsible for the loss of much ying time. Airsickness, and some of the injuries, colds, headaches, atigue states, and psychologic disorders were clearly related to flying. he psychiatric problems were of chief importance and were dis-overed, for the most part, indirectly, because of abnormal behavior nd difficulties in flying. Airsickness and overfatigue were also fre-uent and important complaints. The extremely low incidence of erious organic disease, including venereal infection, is noteworthy.

CONCLUSIONS

1. A comprehensive analysis of the work actually done by physicians esponsible for the care of flying personnel should lead to a clearer onception than is now possible of the clinical aspects of aviation edicine.

2. The greatest consideration should be given to minor illnesses ecause they constitute the great majority of complaints and are re-ponsible for loss of much flying time.

3. Nearly all complaints are more frequent in hot than in cool eather. The reasons for this should be studied further.

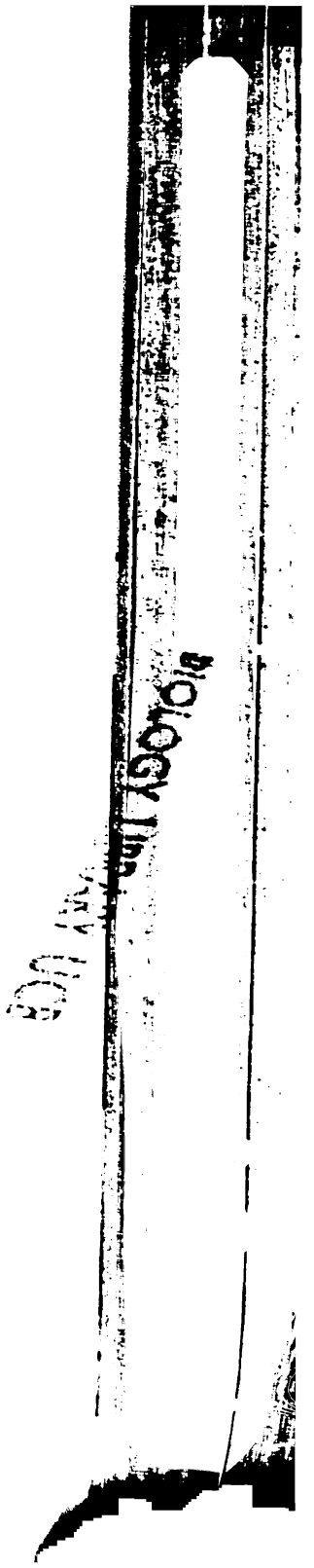
4. Food poisoning, a common complaint, should be prevented.

5. The chief factor in airsickness is the type of flying done.

6. As the student aviator progresses in his work and becomes more ighly motivated, he does not go to the dispensary so frequently ith complaints of a minor nature.

7. The indirect manner in which the majority of psychologic isturbances were discovered suggests that closer rapport between ying personnel and the medical officers is needed. Aviators are uch more inclined to seek medical care and advice for organic rather an psychiatric disorders, and an educational program designed to reak down this reserve should be instituted.

8. In view of the incidence and importance of the psychologic isturbances, the criteria used in the original selection of flying per-onnel might properly come up for review and possible revision.



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DIPHTHERIA IN THE TROPICS

A REPORT OF 18 CASES ON A UNITED STATES NAVAL HOSPITAL SHIP

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During the latter part of 1942 and the first two months of 1943, a number of cases of diphtheria occurred among our armed forces in the Solomons and neighboring islands. Eighteen such patients were observed on this ship during their evacuation at from 10 to 60 days following the onset of their illness. Of the 18, 13 had developed some form of postdiphtheritic paralysis, one with fatal result.

Diphtheria is not uncommon in the tropics, but is a much milder disease than in temperate climates. In fact, its presence had not been suspected in most of our patients until the paralysis appeared. Diphtheria in the tropics is nevertheless potentially dangerous. It may be dangerous to the individual contracting it who is unfortunate enough to develop serious paralytic or myocardial complications. It is particularly dangerous epidemiologically because the transfer of the infection to the temperate zone is followed by a greatly increased virulence. The tropics thus constitute an ever-present reservoir from which diphtheria can be readily reintroduced into cooler climates. It seems important, therefore, to record our observations and to call the attention of medical officers serving for the first time in the tropics to the problem which diphtheria presents in these latitudes.

Table 1 summarizes the data regarding our 18 cases.[1]

The question arises whether the infection had its origin from healthy carriers among the military personnel, or from carriers or patients among the native population of the islands. It is believed that the latter is the more likely source. The military units to which these patients belonged had all been away from the United States for periods of at least 5 months. Outbreaks of illness contracted

[1] Owing to lack of space it was found necessary to omit the detailed case reports.—*Editor.*

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TABLE 1.—*Summary of data of 18 cases of diphtheria*

Case	Age	Service	Island	Date of onset	Tonsillitis diagnosis	Antitoxin paralytic phenomena									Throat culture		
						Units given	Day disease started	Pharynx	Weeks after onset	Extremities	Weeks after onset	Ocular	Weeks after onset	Myocardial phenomena	Results	Day of disease	Outcome
1	25	USMC	A	13 Oct	----	10,000	20										
2	34	USN	B	1 Nov	----	100,000	28	pos.	4	pos.	5	pos.	4	pos.	pos.	19	R
3	22	USMC	A	2 Nov	----	60,000	7	pos.	4	----	----	----	----	pos.	pos.	28	DD
4	21	USMC	A	6 Nov	----	40,000	4	pos.	5	pos.	5	----	----	----	pos.	7	R
5	22	USA	A	13 Nov	pos.	----	----	pos.	2	----	----	pos.	2	----	----	4	R
6	24	USA	A	(Late)—Nov	----	----	----	pos.	4	pos.	4	----	----	----	----	60	R
7	21	USA	A	23 Nov	pos.	----	----	pos.	4½	----	----	pos.	4½	----	----	45	R
8	22	USA	A	23 Nov	----	----	----	pos.	3½	pos.	3½	pos.	3½	----	----	52	R
9	21	USMC	A	27 Nov	pos.	70,000	5	pos.	4½	pos.	4½	----	----	----	pos.	52	R
10	19	USMC	A	28 Nov	pos.	----	----	pos.	3	----	----	----	----	----	----	5	R
11	31	USA	A	5 Dec.	pos.	----	----	pos.	3	----	----	----	----	----	----	11	R
12	21	USA	A	(Early)—Dec.	----	----	----	pos.	1	----	----	----	----	----	----	49	R
13	21	USMC	A	23 Dec	pos.	----	----	pos.	1	----	----	----	----	----	----	49	R
14	25	USN	B	9 Jan	----	50,000	10	pos.	2	pos.	2½	----	----	----	pos.	22	R
15	21	USN	B	12 Jan	pos.	50,000	2	----	----	----	----	----	----	----	pos.	10	R
16	21	USMC	B	10 Feb	pos.	30,000	3	----	----	----	----	----	----	----	pos.	2	R
17	24	USMC	C	12 Feb	pos.	150,000	3	----	----	----	----	----	----	----	pos.	3	R
18	24	USMC	B	18 Feb	pos.	50,000	2	----	----	----	----	----	----	----	pos.	3	R
																2	R

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from carriers in their own groups should have developed sooner, especially under the crowded conditions of transports. It might have been expected, too, that an infection originating in carriers from the United States would have been more severe. Diphtheria originating in the tropics is known to be a relatively mild disease, with infrequent complications and an almost negligible mortality.

It is difficult to say whether all of the cases were part of a single outbreak, or were incident to several outcroppings of an endemic infection. Obviously there must have been many more than the 18 cases since even in temperate climates patients with paralytic phenomena comprise only 10 percent of the cases and in the tropics the figure is said to be much less. Of the 13 cases with paralysis, 11 were not suspected of being diphtheritic for a week or more after the onset; 9 were not suspected until paralysis had appeared; and 3 had not even been admitted to the sick list during the attack of sore throat. Consequently the total number of cases is unknown and contacts could not be traced.

It appears perhaps more likely that the 18 cases were incident to several outcroppings of an endemic infection. At least this is what the scattered occurrence of the cases during 5 months and their presence in many different military units on 3 different islands seem to indicate. There were 9 marines, 6 soldiers, and 3 sailors in our group. The 9 marines were from 5 different regiments and 2 other units. In the 2 instances where there were 2 marines from the same regiment, these were not from the same company. Of the 9 marines, 6 became ill on Island A, 2 on Island B over 500 miles away, and 1 on Island C 200 additional miles away. The 6 soldiers were all from the same regiment, but from 5 different units and all became ill on Island A. The 3 sailors were from 3 different units, including a ship at anchor at Island B. One of these patients, a hospital corpsman, had attended diphtheria 5 weeks before. There was no known infectious contact for the other two.

Island A, where 12 of our cases occurred, was the most advanced position. Throughout the time covered by these cases, there prevailed the unsanitary conditions of a combat zone with almost daily battle action, primitive mess facilities, and an unwillingness of the men to complain of so simple a thing as a sore throat. At Island B, where 5 cases arose, there was no actual threat of battle except for an occasional air raid or brief shelling from the sea, but crowding and pressure of work detracted from the efficiency of sanitary and medical measures. Island C, which furnished only 1 of our cases was the least advanced, with the best sanitary conditions. Although these points appear to support the likelihood of multiple origins of infection for our group, it must be pointed out that on Island A there was some intermingling

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of various military units in rest areas and that there was much traffic between Islands A and B, both by plane and by ship, with almost daily evacuation of casualties from A to B. This was also true, but to a much less extent, for Islands A and C. A single focus of infection on Island A cannot, therefore, be excluded.

There is little doubt that our patients had diphtheria, because of the communicability of the disease and the frequency of late involvement of the nervous system. Only in case 1, however, was an organism isolated on board this ship, which was morphologically characteristic of Corynebacterium diphtheriae and this was not virulent for guinea pigs. In all other cases in which a bacteriologic diagnosis was made, the organism was isolated in other medical activities before the patients were admitted to this ship. So far as we can learn these diagnoses were based on the morphologic characteristics of the bacilli in smears and cultures. Facilities were not available in the field for a more extensive bacteriologic investigation of the disease.

It may be argued, however, that the apparently inconsequential onset of the disease and the relatively high age incidence of 23.3 years might indicate that the strain of Corynebacterium diphtheriae responsible for this outbreak differs in the character of its toxin from that commonly found in the United States. The patients acquiring the disease in this area might have been immune to diphtheria at home. Although the available data is insufficient to prove or disprove this contention, it is well to point out the following observations. First, none of our patients was certain that he had been previously immunized against diphtheria. Second, about 10 percent of the population in the United States are Schick positive when they reach adult life and are presumably susceptible to diphtheria. These may be the very individuals who contracted the disease in the present instance. Third, diphtheria in the tropics as has been pointed out is notably a mild disease with a low mortality rate and a low percentage of late nervous system complaints. Finally, it has not been demonstrated experimentally that the toxins of different strains of Corynebacterium diphtheriae are dissimilar in any way but in the quantity of toxin produced.

It has been shown statistically that chronic foci of infection in the oro-nasopharynx increase the susceptibility of an individual to diphtheria. As shown in the table, 10 of our 18 patients were said to have had "tonsillitis" at the onset of their illness, or showed definite evidence of septic tonsils on this ship. In one, a peritonsillar abscess was suspected and the anterior pillar subjected to incision.

In temperate climates, diphtheritic paralysis first appears 2 or 3 weeks after the onset of the infection. It tends to be limited to the cranial nerves, but involvement of the extremities may predominate or

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both may be affected. The lower extremity is much more often involved than the upper. As a rule, paralysis begins in and is limited to the uvula and palatal muscles and is first recognized by the onset of nasal speech and the regurgitation of fluid through the nose. Such paralysis is flaccid. The insensitive soft palate and uvula do not move. The uvula in its midposition moves when the mouth is opened. In unilateral paralysis, however, the uvula or the median raphe of the palate will deviate to the normal side and, in bilateral paralysis, the uvula hangs in the midline but does not move. The pharyngeal reflexes are tested by eliciting the gag reflex with a tongue depressor. In unilateral paresis of the pharyngeal constrictors, the posterior wall of the pharynx will make a rapid movement to the normal side and partly disappear under the posterior arch and lateral ligament of the uninvolved side. The ocular nerves are next most frequently attacked, especially those distributed to the ciliary muscles. This produces paralysis of accommodation with preservation of the pupillary reflex, but inequality of the pupils, diplopia, strabismus, or ptosis are not uncommon findings.

When the bulbar nerves are involved, there is not only paralysis of the laryngeal and pharyngeal muscles but also either partial or complete anesthesia of the mucous membrane. The presence of aphonia, hoarseness, or dysphagia should lead to the suspicion of paralysis of one or both vocal cords or inability to close the glottis. Paralysis of the glottis is followed by aspiration pneumonia and death. The prognosis is poor when the bulbar nerves are involved. The facial muscles and tongue are rarely affected. When they are, the facial expression is lost and the tongue shows a variety of changes, chief among which are deviation from the midline, tremor, atrophy, and impairment of taste sensation in its posterior third. Very occasionally the neck muscles are involved so that the head falls helplessly upon the shoulders.

The appearance of tachycardia due to paralysis of the vagus is always of grave prognosis. The dyspnea following involvement of the phrenic nerve is especially severe when both phrenic nerves are paralyzed. In fact, paralysis of the vagus and especially that of the phrenic terminate in death.

The general polyneuritis of diphtheria may simulate pseudotabes or eventuate in complete paralysis of the lower extremities. The extremities, usually the lower, become paretic and there may be ataxia, disappearance of deep reflexes, steppage gait, footdrop and impairment of all forms of sensation. Although the paralysis of the extremities appears later than that of the palatal and pharyngeal muscles, it persists for weeks and even months after the palatal and pharyngeal involvement has vanished.

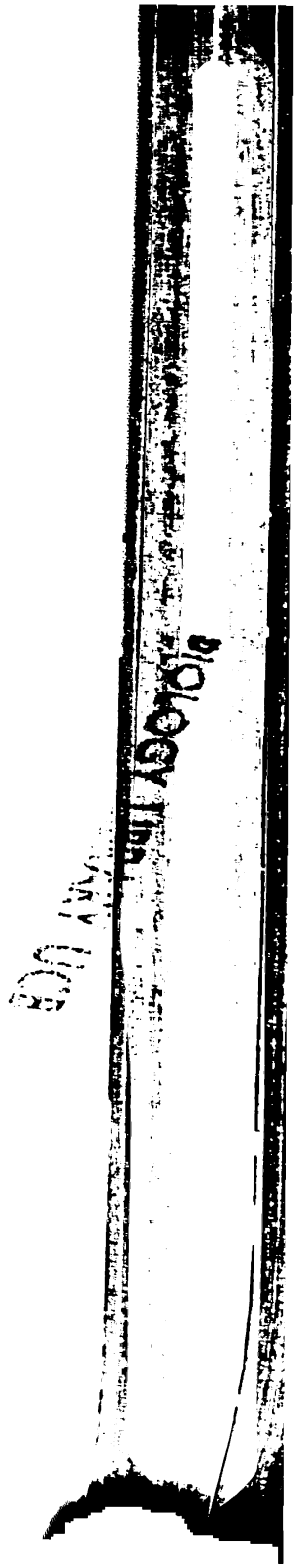
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As previously mentioned, the incidence of peripheral paralysis in diphtheria is only about 10 percent in the United States. Thirteen of our 18 patients had varying degrees of paralysis of the pharyngeal muscles; 6 of these also showed involvement of the extremities; and 4 had ocular palsies. There must therefore have been many cases without paralysis which were not diagnosed as diphtheria. The menace of infective spread under these circumstances is obvious.

The administration of antitoxin from 4 to 28 days after the onset of throat symptoms in 5 of our patients was ineffectual in preventing paralysis. In the last 4 cases, however, in which sufficient antitoxin was given within 3 days of the onset, paralysis did not occur. This observation confirms previous experience that diphtheria toxin becomes fixed in the nervous system early in the course of the disease, after which time it cannot be neutralized by antitoxin. The earlier recognition of the disease in these last 4 cases was evidently the result of previous experience that an apparently innocuous sore throat may be diphtheria.

Paralysis of the pharynx was recognized from 1 to 5 weeks after the onset of the sore throat, with an average of 4 weeks. Other pareses occurred at about the same time. In cases 5, 12, and 13 paralysis was thought to have occurred within 1 or 2 weeks of the onset. It is quite likely that this was not an accurate estimate and that the onset of the infection occurred at an earlier date. The fact that throat cultures were already negative when the paralysis was recognized would confirm this assumption. On the other hand, the diphtheria organism can persist in the pharynx for long periods. This is apparent in cases 1, 2, 3, 4, and 9 in which cultures were positive from 3 to 5 weeks after the onset. The problem of carriers is therefore apparent.

Fortunately postdiphtheritic paralyses as a rule tend to recover completely and within a matter of weeks. In our patients improvement was at times apparent in the course of a few days. But that there may be fatalities from paralysis is illustrated by case 2. On admission to this ship he was not in a critical condition. However, there was paralysis of the pharyngeal muscles, the extra-ocular muscles were weak, and there were generalized paresthesias. During the next 3 days the right side of the diaphragm first became paralyzed, and dyspnea and cyanosis set in. At this time had a respirator been available his life might have been saved. The degenerative changes in the medulla and anterior horns of the spinal cord found at autopsy suggest that the central nervous system was involved as well as the peripheral nerves. In fact destruction of the nuclei of the phrenic and vagus nerves is said to cause the respiratory paralysis rather than involvement of the nerves themselves. The presence of a diffuse interstitial myocarditis of both ventricles of the heart must have been a con-



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tributory factor in the patient's death. Corynebacterium diphtheriae was not isolated and diphtheria antitoxin was not given until 4 weeks after the onset of his illness, a time interval too long for treatment to be effective.

In retrospect a few points are worthy of emphasis. In the first place, any sore throat may be due to diphtheria. What is more, in the tropics, there is a greater likelihood of finding diphtheria than there is in the United States. It is a long-known fact that diphtheria at the onset usually has a deceptively mild clinical picture. Therefore it should be an inflexible routine to make smears and cultures of all cases of sore throat, regardless of their apparent mildness.

What is less well appreciated is that the mild diphtheria of the tropics when introduced into temperate zones rapidly changes to the serious form of the disease. In order to safeguard the United States against this occurrence, it is important that diphtheria and the resulting problem of carriers in military personnel on tropical duty should be recognized and dealt with effectively.

SUMMARY AND CONCLUSIONS

1. Eighteen cases of diphtheria seen aboard a hospital ship in the tropics are cited.

2. Thirteen of the patients had peripheral paralysis, one of whom died of respiratory failure.

3. In 11 of the 13, diphtheria was not suspected until a week or more after the onset; in 9 of them not until paralysis had developed.

4. Because of the difficulties encountered incident to military operations, the epidemiology and bacteriology of this group of cases are problematical. It is believed, however, that the sources of the infection lay in the native population and not in carriers among the military personnel.

5. The efficacy of antitoxin in the usual doses suggests that there is no fundamental immunologic difference between the strains of Corynebacterium diphtheriae in the tropics and those in the United States.

6. Since diphtheria in the tropics is a comparatively mild disease with low mortality, it is frequently unrecognized. Yet it may be followed by peripheral paralysis, which when the respiratory muscles are involved may be fatal. Moreover, the introduction of the mild tropical disease to temperate zones is followed by an increased severity.

7. Paralysis cannot be prevented by antitoxin given after the third day of the disease.

8. It should, therefore, be routine to make smears and cultures at once in all cases of sore throat, regardless of the apparent mildness of the clinical picture.

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THE ROLE OF SEDATION IN MILITARY MEDICINE

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The medical officer must be prepared to cope not only with physical illnesses and injuries, but also, and often of even more importance, with the intense emotional reactions incidental to war.

In the management of psychiatric casualties of war, the attitude which offers the best approach is the one which recognizes that no person can be physically ill without his emotions in some way being involved. Even the initial physical reaction to combat, that of simple fatigue, and its more severe gradations of exhaustion and collapse, have psychologic corollaries. It is also evident that since tension and anxiety are fatigue-producing, fatigue as a psychosomatic entity is present in varying degrees in all persons who have engaged in combat. It is important to remember that persons who are emotionally predisposed as well as those who are merely exhausted exhibit similar clinical pictures.

It is of no practical significance to determine which existed first, anxiety or fatigue (the emotional condition or the physical illness). It is sufficient to recognize their indissolubility and to treat both simultaneously.

Since the majority of reactions to combat conditions are of a relatively mild degree, it is necessary to consider the varieties of treatment indicated in the *early* phases of emotional reactions to battle stress. This may be done by grouping the responses into four categories:

1. Simple fatigue and mild fear states.
2. Combat fatigue states.
3. Psychoneurotic reaction types.
4. Psychotic reaction types.

GROUP 1.—SIMPLE FATIGUE AND MILD FEAR STATES

Simple fatigue and mild fear states constitute the earliest manifestations of the psychosomatic reaction to the stress and strain of combat conditions. The symptoms are mild degrees of tension, restlessness, nervous irritability, anorexia and insomnia, as a result of a more than usual fatigue incidental to war conditions. Not infrequently these patients are overlooked by medical officers because their

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symptoms are mild and their complaints minimal. Often the patient himself fails to appreciate the true nature of his symptoms, and is likely to attribute his tachycardia, mild diarrhea, vague nausea, or slightly labored respiration to a gastro-intestinal upset, excessive smoking, the drinking of contaminated water, or other causes of a purely physical nature.

Since this phase of the patient's response is so closely allied to physical symptoms of overactivity itself, it is only of academic interest to inquire into the psychiatric etiology. These reactions must be considered normal and appropriate to the stress undergone and as such they may be entirely relieved by rest. Since physiologic rest is at its maximum during sleep, it is desirable that all initial therapeutic measures be directed to this end. Other forms of psychiatric treatment are contraindicated at this time.

The therapeutic value of sedation in these cases cannot be overstressed. As soon as circumstances permit, the patient should be made as comfortable as possible and given adequate doses of sedation. By insuring adequate rest (12 to 15 hours), the patients presenting this mild symptom picture can be completely restored to their previous level of functioning efficiency. In table 1 are tabulated the standard drugs used in each of the four groups. The preferred routes of administration are indicated for each group and each drug. The dosage as recorded is given in terms of relative potency.

The physiologic responses to emotion are such that anxiety and fatigue are not conducive to the normal absorption of materials from the upper gastro-intestinal tract. The variations in tonus and secretions, along with sphincteric alterations, preclude rapid absorption. This disadvantage may be overcome by measures designed to hasten the digestion of capsules which are used as the containers of the standard preparations. Perforation of both ends of the capsule by several pin-point punctures is one method useful in overcoming any delay in its digestion. The alternative of suspension of the drug in liquid vehicles has several disadvantages. Most barbiturates are only slightly soluble in the usual vehicles and, in addition, such vehicles only poorly disguise the drug's bitter taste. Drugs, such as sodium alurate, phenobarbital, amytal, and barbital, are prepared in tasteless tablet form and are therefore preferred in the control of mild or moderate tension.

GROUP 2.—COMBAT FATIGUE STATES

The psychosomatic reactions classified in this category are of a more severe grade than those mentioned in group 1. The characteristic symptoms are those of fatigue, recurrent night terrors, startle reaction, objective evidence of underlying fear state (insomnia, tremor, in-

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TABLE 1.—*Standard drugs used in groups 1 and 2*

	Group 1	Group 2		
	Simple fatigue	Combat fatigue		
Route of administration	Oral	Oral	Intramuscularly	Intravenously
Paraldehyde (liquid form)	4 to 6 cc. (℥i—iss) plain or in water or saline 3 or 4 x/day prn.	4 to 24 cc. (℥i—vi) prn 3 to 4 x/day	Not advisable	1 cc. plain or preferably 5 cc. of a 10% solution (saline) slowly 1 to 2 x/day prn.
Chloral hydrate (Solid, but may be prepared in liquid form).	Gm. 0.6 to 2 (grains 10 to 30) 3 or 4 x/day prn.	Gm. 0.6 to 2.6 (grains 10 to 40) 3 to 4 x/day prn.	Contraindicated	Contraindicated.
Sodium bromide	Gm. 0.6 to 3.0 (grains 10 to 45) 3 x/day prn.	Same as group 1 (of less value)	do	Do.
Barbiturates:				
Amytal (tablet form)	Gm. .097 to .3 (grains 1½ to 4½) 2 to 3 x/day prn.	Same as group 1	do	Do.
Barbital (tablet form)	Gm. .5 to 1.0 (grains 8 to 15) 2 to 3 x/day prn.	do	do	Do.
Phenobarbital (tablet form)	Gm. .097 to 0.2 (grains 1½ to 3) 3 to 4 x/day prn.	do	Sodium phenobarbital in 2½ to 10% solution (grains 1 to 3; gm. .06 to .194).	Contraindicated unless especially prepared.
Sodium alurate (tablet form)	Gm. .115 to 0.2 (grains 1¾ to 3) 2 to 3 x/day prn.	do	Contraindicated	Contraindicated.
Sodium amytal (capsule form)	Gm. .18 to .54 (grains 3 to 9) 2 to 3 x/day prn.	*Ordinary dosage:* gm. .18 to .54 (grains 3 to 9) t. i. d. *Narcosis:* gm. 0.36-up (grains 6 and up) q. 4. h. prn.	See below	See below.
{Pentothal sod. (ampules)} {Sodium amytal (ampules)}	For {intramuscular / intravenous} use	0.06 to 0.5 gm. (grains 1 to 7½) in a 2½ to 10% solution. No more than 5 cc. in one site.		0.06 to 0.5 gm. (grains 1 to 7½) in 2½% solution.

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creased sweating, mood change, etc.). Recovery is possible in a large percentage of these patients if adequate treatment is instituted during the *early* phases.

Rationale of sedation.—The use of sedation preliminary to and in conjunction with the psychotherapy of combat fatigue and panic states has been shown to be most effective in the rapid rehabilitation of the patient. All efforts designed to relieve tension by psychotherapy alone, such as explanation, suggestion, hypnosis, or re-education, are relatively futile against panic. Without the intervention of appropriate treatment, a vicious cycle is set up whereby the precipitated tension gradually mounts, as a consequence of progressive fatigue and heightened irritability, and the result is more anxiety and often acute panic. The rationale of sedation is based upon the need for a rapid "blanking out" of consciousness and these attendant emotional and physical symptoms.

The decision has to be made as to whether the symptom picture as it presents itself is one which requires merely moderate sedation for a short period of time or a narcosis treatment. In the former case the sedation regimen is incorporated in the proposed psychotherapeutic program. In the latter, however, sedation is the only treatment. As a general rule, narcoses for periods of less than 3 days are not so successful as ones of longer duration.

Choice of drugs and methods of administration.—Sedation not only affords a measure of custodial care and physiologic and psychologic rest, but also prepares the way for subsequent psychotherapy. The method by which the sedation is administered and the choice of the medication is an important consideration. The milder hypnotics, which are adequate for group 1 cases, such as the bromides, phenobarbital, amytal, and chloral hydrate, are relatively useless in the presence of heightened emotional reactivity. It is sometimes difficult to elicit the cooperation which is required for frequent oral administration. Drug potency, too, is attenuated in a state of panic, and in this case other routes of administration are preferred.

Although the choice of available drugs in the treatment of this group of patients is wide, the selection narrows down to two main classes, the opium alkaloids and the hypnotic hydrocarbons (paraldehyde, chloral hydrate, barbiturates). In most instances, there is a greater margin of safety afforded by the use of barbiturates. In the large doses frequently required to produce narcosis, the barbiturates are less toxic. Also, the wide range of choice in the barbiturate group allows for the synergistic blending of different agents to accomplish the desired degree of sedation in any situation.

Narcosis technic.—The optimum narcotic state is one in which the patient is kept in a nonrousing stupor for 20 to 22 out of each 24 hours.

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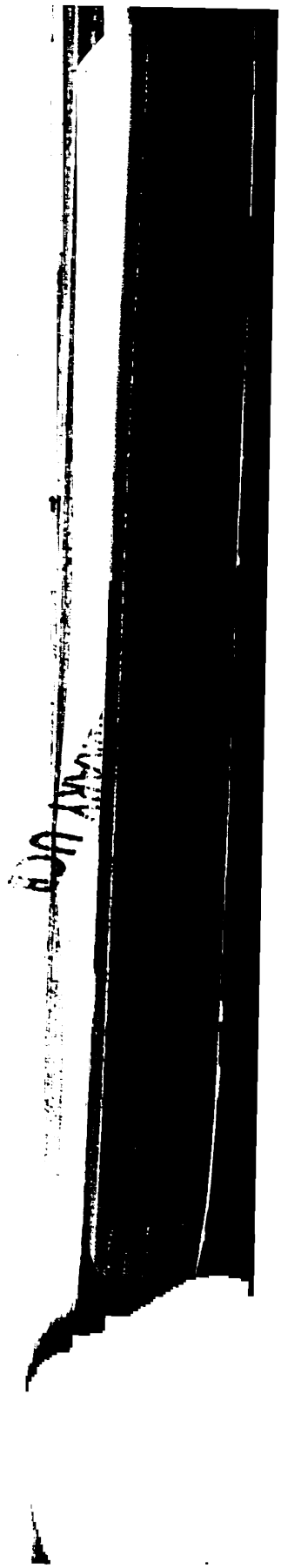
It is advisable to allow the patient to rouse sufficiently once in the morning and once during the night to facilitate nursing care and food intake.

The method of choice in initiating a narcosis in emotional states less acute than panic is by the oral administration of sodium amytal. Usually, 6 to 9 grains every 4 hours, orally, is sufficient to maintain the desired relaxation for the first 3 days. If the treatment is to be conducted over any period of time, it will soon become obvious that the dosage of the drug has to be increased progressively. A smoother course of sleep will follow a continued, regular administration than one in which larger doses are given at longer intervals. The former method precludes the undesirable reaction of acute central respiratory depression. With an indwelling small caliber nasal tube, gavage affords a convenient method of administering exact amounts of the medication. When this route is used, the nonsoluble form of sodium amytal can be suspended in a suitable diluent. This procedure not only favors a more rapid absorption, but is also a means of insuring adequate fluid intake. In addition, general nutrition may be supported by suspending the selected drug in orange juice fortified with sugar. Small quantities of food and vitamins may also be given by this route.

Sodium amytal has been most frequently used by most therapists in both the mild and profound narcosis treatments. The relatively low incidence of idiosyncratic reactions, the length of time over which it exerts its sedative effect and the absence of associated disturbances are some of the advantages enumerated. Cases have been recorded in which as much as 450 grains have been given over a period of 24 hours in order to maintain a satisfactory narcotic level. The usual dose for the average narcosis of 10 days' duration is about 120 grains in 24 hours.

A careful observation of blood pressure, pulse, and respiratory rates, and a cursory neurologic examination (eliciting of corneal reflex, estimation of degree of muscle tonicity, and state of the tendon reflexes) are sufficient to judge accurately the depth of the narcosis. There are also associated features to be considered in cases where the narcosis is to be given over a prolonged period of time. For instance, there must be adequate fluid intake. The need for nutrition is proportionate to the state of the patient's physical condition. In the average well-nourished individual, the decreased food intake incident to a narcosis conducted over a period of several days is not harmful metabolically. Bowel and bladder function must be regulated and oral hygiene maintained in deep narcosis therapy.

Not infrequently, oral administration is precluded by some associated gastro-intestinal difficulty. Since intravenous administra-



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tion produces too great a depth of narcosis, the intramuscular administration of drugs such as sodium phenobarbital, in doses ranging from 1 to 3 grains every 2 to 4 hours, provides a solution to this difficulty. Phenobarbital exerts its sedative effect over a period of approximately 6 hours, and whereas the depth of narcosis, using safe amounts of the drug, is not so great as that obtained by the use of sodium amytal, it is a useful drug for intramuscular treatment. It is not a drug of primary choice, particularly in prolonged narcoses, because there is an associated higher incidence of idiosyncrasy than with most other barbiturates.

Pentothal sodium and sodium amytal are the safest forms for intravenous therapy. They are readily soluble in distilled water or saline and with the precautions of slow administration narcosis to the point of anesthesia can be obtained in a few minutes. It is essential that great care be exercised in intravenous administration of barbiturates. A full minute should be required for each cubic centimeter given and the pharmacologic antidotes should be readily available. Brain-stem center toxicity is the complication to be avoided. Adequate airways must be maintained and all the precautions of administering a general anesthetic should be taken. Once unconsciousness has been achieved, it can be maintained by the periodic administration of additional amounts of the drug by gavage or parenterally. The criteria for the need of additional medication are progressive wakefulness and increased response to environmental and physical stimuli with associated increased emotional tension.

In deep narcotic stupors the use of an airway such as is commonly employed in conjunction with inhalation anesthetics is invaluable. This precludes respiratory obstruction resulting from tongue swallowing and pharyngeal muscular relaxation.

Because of decreased tidal respiration and slowing of the respiratory rate, pulmonary complications are among the undesirable features often encountered. All hypnotics, sedatives and narcotics have a tendency to suppress the cough reflex, and inspiration of nasal and bronchial secretions is not uncommon. Frequent turning of the patient is helpful in avoiding hypostatic pulmonary congestion with the possible sequel of pneumonia.

An emergency kit should be on hand prior to instituting narcosis treatment. Routinely it should contain a respiratory airway, a well-padded mouth gag, jaw forceps, a soft rectal tube, a sterilized catheter and other genito-urinary supplies. The drugs should include epinephrine hydrochloride in 1:1000 solution, ampules of caffeine sodiobenzoate (7½ grains), metrazol in 10 percent solution, coramine, 50-percent dextrose solution, hypodermic tablets of atropine and morphine, and benzedrine sulfate and ephedrine sulfate. Several hypo-

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dermic and intravenous needles with 2, 5, 20 and 50 cc. syringes are included.

GROUP 3.—PSYCHONEUROTIC REACTION TYPES

This group includes those classical reaction types which manifest themselves in combat situations. In a high percentage of the cases, there is a history of pre-existent emotional instability. The stress of ombat conditions added to the already faulty adaptation of the patient is sufficient to precipitate a frank psychoneurosis. Because of the nature of the condition and the usual long duration of adjustment, there is a tendency to greater reaction on the part of these patients than those of groups 1 and 2. Fulminant panic states are the equivalent symptoms of the anxiety tension reactions seen in group 1 patients. In group 3, major hysteria (blindness, deafness, paralysis, etc.) is analogous to the mild psychosomatic disturbances of groups 1 and 2.

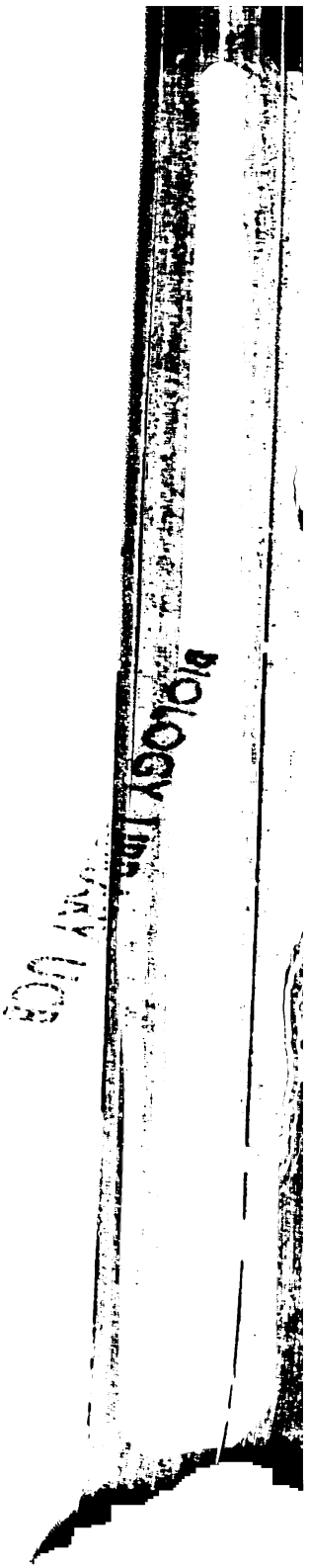
The presence of authentic fatigue in a neurasthenic personality often is sufficient basis to permit that individual to overreact and attribute to it all future symptoms of apathy and fatigue. Then too, as concerns the anxiety neurosis, only by longitudinal history can the diagnosis be positively established. The syndrome as such is similar in all external repects to the anxiety manifestations of the first two groups.

Since the diagnosis of psychoneurosis is dependent upon the patient fitting into a clinically descriptive pattern which has existed over a long period of time, a clear differentiation of these patients can be made only in retrospect.

The general management of these patients is similar to that outlined in groups 1 and 2. There are two factors by which this group may be separated from the others. First, the prognosis for complete recovery and return to duty is less favorable. Second, these individuals are apt to have a more severe reaction because of their predisposition and the nature of their responses.

In acute panic states and other conditions characterized by marked overactivity, the rapid induction of narcosis is indicated. Although intravenous paraldehyde in 10-percent solution is less desirable than intravenous barbiturates, there may be some situations in which it may be used. Paraldehyde is a volatile hydrocarbon and is eliminated by the kidneys and lungs. In cases of untoward reactions from other sedative drugs, as well as in the presence of liver damage, it may be used. The same precautions of slow, careful administration over a long period of time as was recommended for the barbiturates have to be observed.

Except in emergencies, the use of morphine and its derivatives is contraindicated. The danger of addiction in psychiatric patients is greater. Opium idiosyncrasy also is more frequent in its occurrence



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than are similar barbiturate phenomena and the depth of narcosis is more difficult to regulate when these alkaloids are used. Tonal changes in the bladder and gastro-intestinal tract are further undesirable features.

TABLE 2.—*Standard drugs used in groups 3 and 4*

	Group 3 Psychoneuroses			Group 4 Psychoses		
Route of administration	Oral	Intramuscularly	Intravenously	Oral	Intramuscularly	Intravenously
Paraldehyde		Same as group 2		4–32 cc. (℥ i–℥ i)	Not advisable	5 cc. of a 10% solution (saline) slowly 1 to 2 x day prn.
Chloral hydrate		do			Same as group 2 (of less value).	
Sodium bromide		Same as group 1 (of less value).			Same as group 1 (of less value).	
Barbiturates:						
Amytal		Same as group 1			Same as group 1	
Barbital		do			do	
Phenobarbital		do			do	
Sodium alurate		do			do	
Sodium amytal		Same as group 2			Same as group 2, narcosis preferable.	
Pentothal sodium		do			Same as group 2	

Toxic reactions to barbiturates.—Toxic reactions following the use of barbiturates may be divided into 3 groups: (1) Those immediately resulting from overdosage, (2) untoward effects, in the nature of fecal and urinary retention, and (3) postnarcotic convulsions.

Overdosage is primarily a result of central respiratory depression. Artificial respiration and the administration of pharmacologic antagonists such as metrazol, coramine, and picrotoxin are usually sufficient to overcome this condition. The small percentage of dermatologic reactions are erythema scarlatiniforme, dermatitis medicamentosa, and infrequently exfoliative dermatitis. Rarely there is an untoward hemopoietic effect in the nature of acute agranulocytosis, hemolytic anemia, and purpura hemorrhagica. Some patients have gastro-intestinal difficulty following a prolonged or heavy administration of barbiturates. This is in the nature of anorexia, nausea, or vomiting, and less frequently diarrhea. Varying the choice of medication and the use of a demulcent are usually sufficient to overcome these symptoms.

The administration of one ampule of prostigmine every 6 hours is of great value in avoiding fecal and urinary retention. Enemas every second day and the use of mineral oil prevent complications arising from fecal impactions. Catheterization carries the possibility of infection and should not be done routinely.

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Convulsions are not uncommon sequelae at the termination of narcosis. Particularly is this true when large amounts of barbiturates have been used for long periods. The rapid withdrawal of the drug then predisposes to a mass motor impulse release. This period of heightened neuromuscular irritability is usually presaged by progressive restlessness and mounting irritability. However, it may be prevented by gradual tapering off of the dosage. In the event of a convulsion, the usual precautions employed in the management of epileptic convulsions are indicated. Convulsions are not without benefit in the treatment of certain psychiatric conditions. As a general rule, however, it is not advisable for the inexperienced in convulsive therapy to permit narcoses to terminate by this means.

It is essential that the physician be present when the patient is regaining consciousness. At this time the patient is most receptive to suggestion and the necessary rapport can be established. Reassurance should be the immediate approach, and permitting the patient to recite the traumatic experiences at this time usually has a very beneficial effect.

GROUP 4.—THE PSYCHOTIC REACTION TYPES

Psychotic reactions are primarily either toxic or exhaustive in origin. However there is nothing unique or characteristic of this type in the form which the reaction takes. The usual manifestations are disorientation, confusion, confabulatory substitution, illusions, delusions, and hallucinations. The paranoid ideation is frequent. The motor reaction is usually either one of marked overactivity or apathy and retardation.

Careful inquiry will usually reveal that these individuals were disposed to this type of response by a pre-existent personality disorder. It must be remembered that if any stimulus is applied for a sufficiently long period, complete breakdown in performance is bound to ensue. Only rarely is the stress situation of such intensity or so protracted as to bring about this reaction in an otherwise normal, well-adjusted individual.

The management of the psychotic reaction types is primarily one of custodial and nursing care and early hospitalization in appropriate institutions. The immediate therapy is similar to that recommended for the psychoneurotic group, the only difference being that the narcosis should be deeper and maintained for a longer period.

Finally it can be stated that the sedative treatment of these conditions is intended only as an adjunct to psychotherapy and other indicated treatment. It provides not only a rapid means of controlling the immediate situation, but also affords a rapid, relatively easy method of contributing to the ultimate rehabilitation of a considerable

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group of persons who have developed untoward psychotic reactions as a consequence of combat experience.

CONCLUSION

Narcoses are practical treatments of fatigue states, particularly when these conditions are protracted and verge on exhaustion syndromes. As a consequence of heightened general irritability, insomnia is a troublesome symptom. Tension is an invariable accompaniment and the relationship between fatigue, heightened irritability and tension acts to preclude sleep with its usual recuperative results. Often marked fatigue states closely resemble the more serious psychoneuroses or even exhaustion psychoses.

Complete rehabilitation within a few days often follows a short period of narcosis. It is necessary to remember that the usual small doses of sedatives are not effective in these conditions, and since the toxicity of barbiturates (sodium amytal particularly) is low, the only consideration need be one of obtaining the desired effect. Used with a reasonable degree of care and judgment, this therapy is effective in the early rehabilitation of the psychosomatic casualities of war.

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AN IMPROVED METHOD FOR ABDOMINAL PARACENTESIS

The free flow of fluid is frequently prevented in performing an abdominal paracentesis by a loop of bowel or a fold of omentum which comes to rest in front of the abdominal opening of the canula. Manipulation of the canula or shifting the patient's position may sometimes dislodge the obstructing tissue. Such manipulation is awkward, if not dangerous, after the patient has been prepared and the canula inserted. A more certain and less awkward method has been found to obviate this difficulty.

The patient is prepared and the trocar and canula are inserted in the usual manner. The cap of the canula is then unscrewed and removed together with the trocar which it holds in place. A rather tightly fitting, well-sterilized, flexible rubber catheter is then gently threaded through the canula which is still in situ. The catheter displaces the obstructing gut or omentum and tends to seek the more dependent portion of the fluid.

Even when fluid flows freely by the ordinary method, the routine insertion of a catheter through a trocar will frequently enable the operator to empty the abdomen more completely. This procedure is equally effective with the patient sitting upright or lying in either lateral position. If necessary the rubber catheter can be gently moved about to encourage drainage without fear of traumatizing any of the abdominal contents.—Levit, S., Lieutenant, junior grade (MC) U. S. N. R.

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PSYCHONEUROSES PRECIPITATED BY COMBAT

ROBERT S. SCHWAB
Lieutenant Commander (MC) U. S. N. R.

JACOB E. FINESINGER, M. D.
and
MARY A. B. BRAZIER, Ph. D.

The incidence of psychoneuroses in the armed services in the present war is so great as to make it one of the major problems brought to the attention of the psychiatrist. These disturbances are found under war conditions among the civilian population, selectees, draftees, and soldiers and sailors on active duty. The variation in the intensity of the psychoneurotic symptoms and of maladjusted behavior has already resulted in the introduction of such new terms as "battle reaction" and "combat fatigue." It is possible in most instances to differentiate between patients whose symptoms are precipitated by unusual conditions, such as battle or shipwreck, in which the patient is exposed to unusually powerful stimuli occurring in dramatic sequence and those who develop symptoms without exposure to combat. The former group is usually referred to as "traumatic" or "combat" neuroses. It is this group of patients that is the major concern of this paper.

The purpose of this study was to ascertain whether patients with persistent psychoneurotic symptoms which were precipitated in combat, had a past history of similar or other psychoneurotic complaints. In addition, an attempt was made to study various physiologic functions under laboratory conditions of rest and stimulus, in order to compare the results with those obtained from psychoneurotic patients who had not been exposed to combat experience, and from a series of normal control subjects.

In a previous survey undertaken for neuropsychiatric data on the survivors of shipwreck, two groups of individuals were studied. The first was a group of 25 psychoneurotic patients who were survivors of shipwreck or sinking by enemy action, and the second was a control group of 41 survivors from shipwreck or sinking who had no neuropsychiatric symptoms. These studies included an investigation of the past history and an appraisal of the current symptoms in an interview lasting one-half hour.

It was found that 72 percent of the psychoneurotic patients gave a history of having had psychoneurotic symptoms in civil life prior to entering the Navy. In contrast to this, only 11 percent of the control group of 41 survivors, when studied by the same method gave a history

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of psychoneurotic symptoms prior to enlistment. Of the patient group, 23 (91 percent) were troubled with disturbing dreams and difficulty in sleeping, and 18 (72 percent) had poor appetite and weight loss. In the control group only 2 (5 percent) were troubled with disturbing dreams or complained of poor appetite and showed loss of weight.

It was interesting to note further that 8 of the psychoneurotic group (32 percent) had suffered physical injury as against 23 of the control subjects (56 percent).

In order to check and evaluate the results of this survey another study was made of 26 patients with psychoneuroses precipitated by combat conditions. These were patients whose symptoms did not respond to the usual therapeutic measures available aboard ship or in the combat zone but were sufficiently serious and incapacitating to necessitate transfer to a base hospital in this country. The symptoms had been present in most cases for over 3 months and in some cases for as long as 1 year after the initial combat experience. At the time of the examination most of these patients were not suffering from other illness or injury and in most instances the physical and neurologic examinations were within normal limits.

As a control series for these patients with combat or traumatic neuroses, a second group was selected of 23 subjects who were not ostensibly suffering from any neuropsychiatric complaints or disorders and who had not come to the attention of the medical staff. These men were of the same age distribution as those with combat neuroses and had been through similar combat experiences. These subjects are referred to in this paper as the control series. In addition, a third group of 25 psychoneurotic subjects was studied who had not been exposed to combat, and whose symptoms developed while in military service at a shore station within the limits of the continental United States. This group is referred to as noncombat neuroses.

All three series of subjects were selected at random and were studied in essentially the same way. The nature of the procedure was described to the man and no one was examined against his will. It was explained that this clinical study would not appear in the health record and that they, therefore, need have no apprehension about its influence on any medical decisions as far as the Navy was concerned. In addition an electroencephalographic examination was made and the men were all subjected to an auditory stimulus, during which records of respiration, heart rate, and muscle tension were made. The data obtained from these various measurements are presented as follows.

INTERVIEW.

The interview was conducted by a civilian psychiatrist and was modeled after a "controlled" interview which had been used in a pre-

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vious study of 150 normal college students now training in the Navy. The interview which lasted 30 to 45 minutes was held in a closed room and arranged so that it could be taken down in its entirety by a stenographer in an adjoining room without the subject's being aware of the procedure. An attempt was made to keep the interview in the form of a free conversation, yet essentially the same topics were discussed with all of the subjects. The following topics were dealt with:

1. The present illness, with special emphasis on a description of the symptoms.

2. School and job history, with emphasis on psychoneurotic symptoms and social adjustment.

3. A brief family history, with emphasis on psychoneurotic symptoms and medical illnesses present in the other members of the family, and on the subject's adjustment to his family.

4. Early childhood history with emphasis on the presence of psychoneurotic symptoms and neurotic traits.

The stenographic records of the interviews were studied and the subjects were divided into four groups on the basis of the following criteria:

1. Severe psychoneurosis. These were individuals who complained of definite psychoneurotic symptoms which had been present for long periods of time and which were severe enough to be disabling. These patients had a history of many neurotic traits in childhood, and a diagnosis of a specific psychoneurosis could be made on the basis of symptoms present before the patient had enlisted.

2. Moderate psychoneurosis. These subjects complained of psychoneurotic symptoms present occasionally for only short periods of time, and which on the whole were not disabling. In this group, however, a diagnosis of a specific psychoneurosis could be made on the basis of symptoms present before the subject had enlisted.

3. Minimal psychoneurosis. In these subjects the history revealed psychoneurotic symptoms which were only very occasionally present, and not in any way disabling or severe. There was no history of neurotic traits in childhood. On the basis of the history, as obtained during the interview, it was not possible to make a diagnosis of a typical psychoneurotic syndrome.

4. No psychoneurosis. In these patients there was no history of psychoneurotic symptoms and no neurotic traits in childhood were reported.

RESULTS.

The incidence of symptoms reported in the group of patients with combat neurosis is presented in figure 1. The striking finding was the large percentage of gastro-intestinal symptoms (85 percent). The patients described feelings of shakiness, jitteriness of the stom-

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ach, feelings of turning and jumping inside. The symptoms peculiar to this group were the severe reaction to loud or even ordinary noises, and the presence of repetitive anxiety dreams, depicting in most cases some aspect of the combat experience. The other symptoms of headache, trembling hands, palpitation or precordial pain found in most cases were typical of anxiety neurosis. The most common diagnosis was anxiety neurosis, which occurred in approximately 80 percent. Most of the other cases were diagnosed as hysteria.

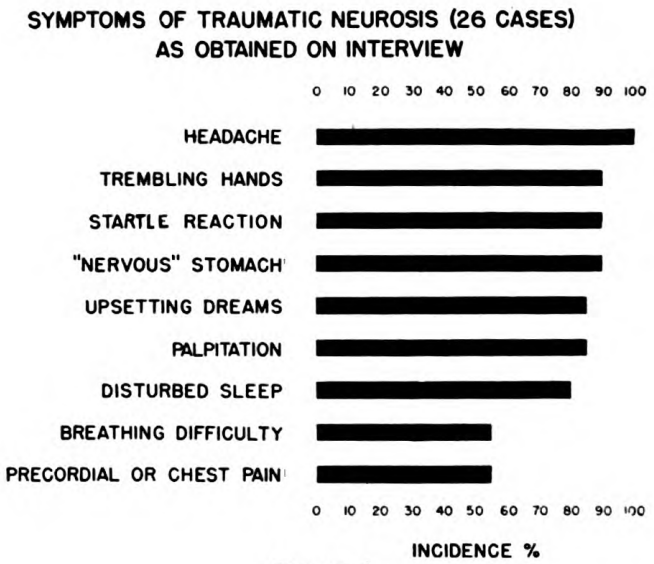


Figure 1.

From the history obtained during the interview, 80 percent of the combat neuroses group could be classified as having severe or moderate psychoneurosis and a further 12 percent had minimal symptoms. Only 8 percent were diagnosed as having no psychoneurosis. Of the 10 patients with noncombat neuroses, 9 had a past history of either severe, moderate or minimal symptoms. The same incidence of psychoneurotic symptoms was found in an additional group of 15 noncombat neuroses by study of their clinical histories. A review of the histories of 25 unselected civilian patients with psychoneuroses studied in the same laboratory, showed that all of these patients had psychoneurotic symptoms previous to the hospital admission (fig. 2).

Of the control subjects exposed to combat without apparent psychoneurotic symptoms, only 17 percent gave a previous history of psychoneurotic symptoms. This compares rather strikingly with the findings in a series of 150 college normals studied previously. In this group a past history of symptoms was elicited in 15 percent of the subjects (fig. 2).

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It is of interest to compare these data with the findings in the naval health records of these patients and in their examinations by naval personnel. A study of the health records of the 26 patients with combat neurosis revealed that a statement describing the

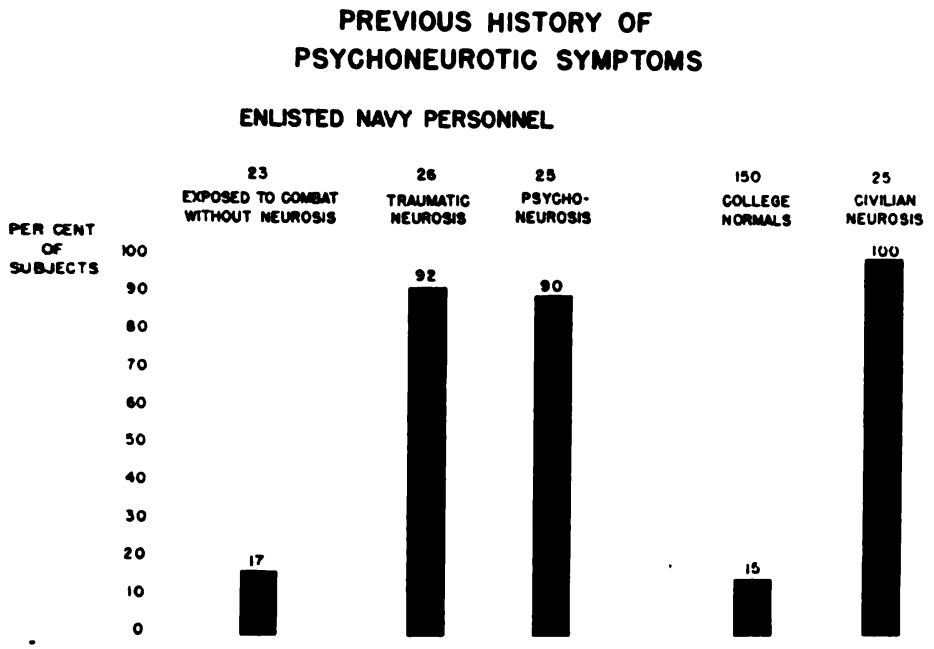


FIGURE 2.

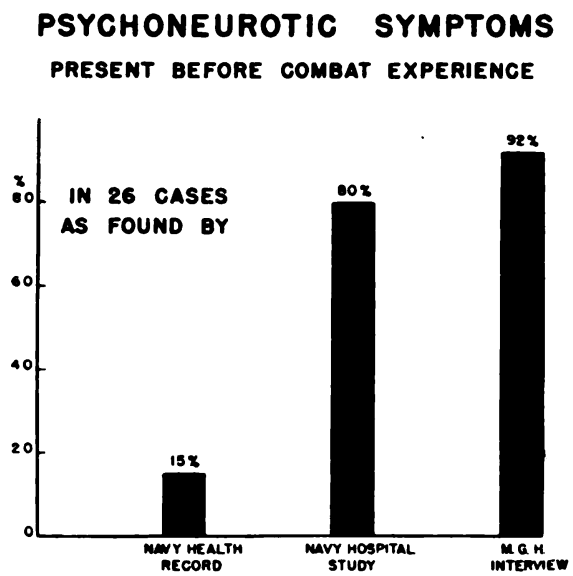


FIGURE 3.

existence of psychoneurotic symptoms prior to admission to a naval hospital was found in only four of these records (fig. 3). Only three of these subjects were diagnosed by psychiatrists at those stations as having pre-existing psychoneurosis, i. e., before admission to the naval hospital.

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In the routine neuropsychiatric investigation during a stay of approximately 2 weeks before diagnosis and disposal, it was found that 21 patients or 80 percent showed some history of psychoneurotic symptoms prior to enlistment. Of this group 65 percent had moderate or severe symptoms and 15 percent mild or minimal. A comparison of the percentage of subjects with previous neurotic symptoms, as described in the health record prior to the base hospital admission, in the routine hospital examination, and in the specially controlled interviews is shown in figure 3.

The principal groups of symptoms which brought these patients to the hospital are shown in figure 4. A number of them had more than one complaint, but their most obvious difficulty was the inability to perform their routine duties.

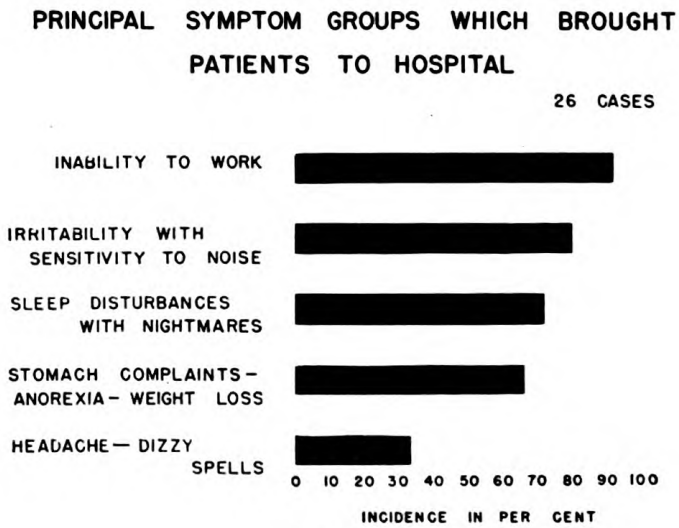


FIGURE 4.

LABORATORY FINDINGS.

Electroencephalogram.—A standard recording was made from 6 scalp electrodes, one-half hour after the subject had ingested 100 cc. of 50-percent glucose in water to ensure a normal blood sugar level. The necessity for this procedure in the control conditions for recording EEG's has been described elsewhere.

The tracings from all these subjects were, on gross inspection, apparently normal and they were therefore subjected to a detailed method of analysis which has been developed in this laboratory for the grading of normal electroencephalograms. For this purpose, the recording of the bipolar occipital potentials during normal breathing is accurately measured for frequencies of component waves and also for voltage. From such measurements many characteristics of the electroencephalogram can be analyzed and studied.

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In the present work the characteristic receiving special study was the distribution of dominant frequencies. By dominant frequency is meant the frequency in cycles per second of the majority of the waves present. It has been found in previous research on civilian psychoneuroses that the distribution of dominant frequencies differed from that of normal controls (which centers around 10 cycles), in that the most prevalent dominant frequency was at 9 cycles with subsidiary peaks in the faster frequencies at 11 and 12.5 cycles.

The EEG's of the group with combat neuroses were therefore compared with those of 31 civilian psychoneurotic patients and 115 college students considered normal. The results are shown in figure 5.

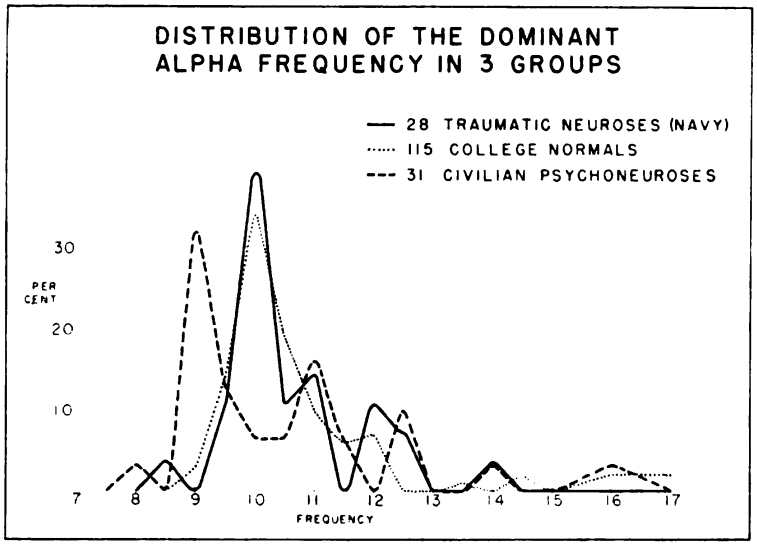


FIGURE 5.

It will be seen that the distribution curve for the group of combat neuroses is very close to that of the college student normals excepting for the fact that the two peaks in the fast frequency range found in the civilian psychoneuroses are again present in this series. The interpretation of these findings is a matter for future investigation.

Auditory stimulus test.—The purpose of this test was to record the reaction of the subject to a disturbing auditory stimulus. This consisted of an extremely high-pitched whistle of mixed frequencies and of great intensity, blown for a period of 3 minutes. During this stimulus period, for 3 minutes preceding it and for a 3-minute recovery period following it, recordings were made of the heart rate, muscle tension and respiration.

The heart rate was recorded from standard electrocardiographyic leads by an ink-written oscillograph; the same instrument recorded simultaneously the electromyogram from surface electrodes attached to

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the flexor carpi muscle of the subject. Thus any gripping movement or tensing of the hand resulted in an increase of potentials from the muscle. These potentials were not only recorded on the electromyogram but were also led through an integrator working on the principle of a condenser which discharged every time a certain amount of electricity collected. Each discharge of the condenser was automatically recorded on the same tracing as the electromyogram, and this record gave a measurement of the tension of the muscle. The ventilation was recorded by having the subject breathe into a Benedict-Roth type of metabolism apparatus equipped with a ventilometer. The ventilation was measured directly from the breathing record and corrected for surface area, which was determined by means of the Boothby-Sandiford nomograph.

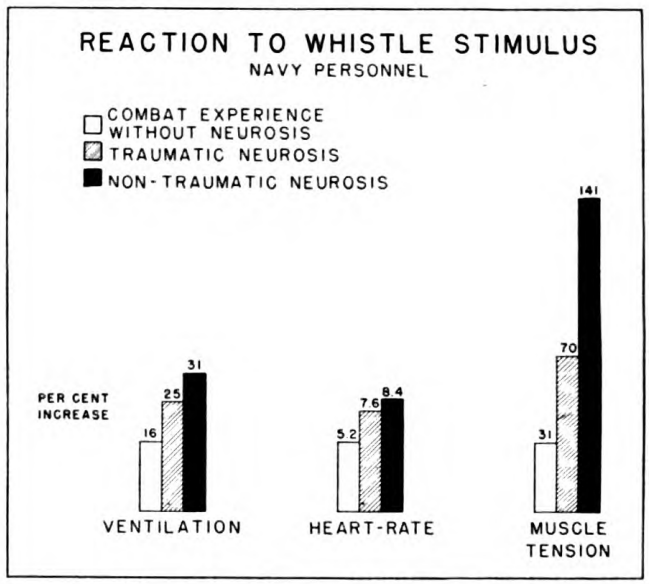


FIGURE 6.

In figure 6 a summary is given of the reactions of the three groups of subjects to this auditory stimulus. It is very striking that in all 3 types of response, i. e., heart rate, muscle tension and ventilation, the control group was the most stable and reacted least to the sound of the whistle. The greatest reaction to the stimulus was observed in the patients with noncombat neuroses. This is brought out most clearly in the muscle tension response.

DISCUSSION

This report indicates that a past history of psychoneurotic symptoms was found in approximately 90 percent of naval personnel who were diagnosed as having a persistent combat neurosis. In the control

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series, a history of psychoneurotic symptoms was found in less than 20 percent of the subjects. As a rule the symptoms present in the control group prior to enlistment were less severe and in most cases less incapacitating. It is to be noted that of the patients with combat neurosis about 25 percent have been in service for over 2 years. This fact would indicate that some patients who in combat develop severe psychoneurotic symptoms may, in the absence of combat conditions, adjust sufficiently well to do their duties with a reasonable degree of efficiency. Of men new to the service, in spite of the history of neurotic symptoms before enlistment, those with combat neurosis had, for the most part, been able to get along in civilian life without hospitalization or treatment for their symptoms.

It is difficult at present to determine exactly the degree of psychoneurotic symptoms which should keep a man out of the service. This study indicates that, were all individuals in whom was elicited a history of psychoneurotic symptoms to be excluded from the armed forces, we would be rejecting almost 20 percent of men who were able to carry out their duties under combat conditions without coming to the attention of the naval neuropsychiatrists. On the other hand, we would also be excluding over 80 percent of the individuals who subsequently developed combat neurosis. From the statistical point of view it would seem that a greater efficiency in selection would be achieved by excluding all men in whom a past history of psychoneurosis exists. This would be especially wise if there were an abundance of manpower.

Patients who develop symptoms without actual exposure to combat situations are more vulnerable than those who develop combat neurosis. It would seem that in these patients the psychoneurotic reaction is elicited by stimuli of much smaller intensity than is the case in the patients with combat neurosis. The auditory stimulus test corroborates this impression by showing that, when exposed to the stimulus, these patients (noncombat neurosis had a greater reaction in respect to measurements of muscle tension, ventilation and heart rate than did the patients with combat neurosis.

Our data revealed that almost every subject exposed to combat conditions reacts to the overwhelming stimuli with subjective feelings of fear and with palpitation, shortness of breath, chest pain, gastric symptoms and tremors. In many, the reactions are of short duration and rarely recur when the individual is removed from the stimuli. In other individuals the reaction persists for a prolonged time. In some patients the reaction, after a slow period of extinction, readily returns in relation to combat stimuli or associated stimuli. Symptoms which last 4 to 5 weeks after exposure to combat conditions, and which are sufficiently aggravating for admission to a base hospital are

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found in patients usually giving a past history of psychoneurotic symptoms. These symptoms can be readily elicited when neuropsychiatric studies can be made by qualified personnel.

SUMMARY

Three groups of naval personnel were examined in this study; 26 cases of combat neurosis, 25 cases of neurosis in individuals not exposed to combat, and 23 control cases exposed to combat without development of neurosis.

This study revealed the following results:

1. A past history of psychoneurotic symptoms was found in approximately 90 percent of both groups with neurosis, but in only 17 percent of the control series.

2. The most striking symptoms in the combat neurosis group were gastro-intestinal disturbances (85%), severe reaction to noise, presence of disturbing nightmares and headaches. The reason for their admission to the hospital on the other hand, in over 90 percent of the cases, was their inability to do their work.

3. The most common diagnosis was anxiety neurosis which accounted for 80 percent of the combat neurosis group.

4. The electroencephalograms of the combat neurosis group were seen to have some of the characteristics which, in another study, have been found to differentiate the EEG's of patients with psychoneuroses from those of normals.

5. An auditory stimulus was found to have more effect on the ventilation, heart rate and, in particular, on the muscle tension, of the group of noncombat neuroses than on those with combat neuroses, the control group being least affected by the stimulus.

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SULFONAMIDES IN TRAUMATIC DENTISTRY

Local application of the sulfonamides proved to be an effective prophylactic measure in those areas in the mouth where the spread of infection is accelerated by fossae, lymph channels, glandular tissue and veins about the face that are lacking in valves and the walls of which are somewhat rigid.

Pain, trismus, and edema were less prevalent, or present in a milder form, in a treated than in a control series of patients.

Formation of healthy granulation tissue followed more rapidly under local sulfonamide therapy. Toxic symptoms and sloughing were negligible.—Stein, A. H.: Prophylactic value of the sulfonamides in traumatic dental surgery. J. Am. Dent. A. **30:** 1918–1922, December 1, 1943.

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CARDIOVASCULAR DISEASE IN THE TROPICS

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The transportation of large numbers of men from the United States to tropical and equatorial areas of the South Pacific has presented a unique opportunity to study and observe the effects of climate and other environmental factors upon certain types of clinical pathology and disease syndromes which have already been carefully investigated at home. I have been particularly interested in the cardiovascular reactions to the tropics of a fairly large group of Navy personnel on combat duty in the South Pacific areas. The impressions given are taken from a statistical survey of the cases seen during the past 10 months' service in this area, and while the actual number of cases cannot be given for obvious military reasons, the percentage figures are correct for the various groups presented. These patients were chiefly observed at U. S. Naval Base Hospital ——, but many cardiac cases were seen in consultation from other naval medical units.

In table 1 I have divided these cardiovasular patients into six clinical groups for purposes of discussion, but many individuals had two or more diagnoses so that the percentage figure given is based on the clinical condition and not on the total number of patients.

TABLE 1.—*Cardiovascular diseases observed*

	Percent	
1. Neurocirculatory asthenia		34
2. Irregularities of the heart:	*Percent*	
A. Extrasystoles	17.0	
B. Paroxysmal auricular fibrillation	3.5	
C. Persistent auricular fibrillation	2.5	
D. Paroxysmal tachycardia	2.0	
E. Heart block	.5	
F. Miscellaneous	.5	26
3. Valvular heart disease		20
4. Coronary heart disease		11
5. Hypertensive heart disease		6
6. Vascular disease		3

NEUROCIRCULATORY ASTHENIA

As in the last war, the largest group of cases in this series falls into the ill-defined syndrome of neurocirculatory asthenia. This is unfortunate because the average medical officer, like the average civilian practitioner, knows so little about the condition and how it should be treated. This is no reflection upon either group of physicians but it is a challenge to the cardiologists who have labored much in the past 25 years with this difficult clinical problem and who have brought

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forth so little except a host of names for the disease. I shall mention a few: Cardiac neurosis, war neurosis, effort syndrome, anxiety neurosis, parasympathetic imbalance, and cardiovascular instability. To these can be added my own phylogenic hybrid, psychosomatic cardiopathy.

Regardless of the name attached to it, this condition is easily recognized and is the most common cause of cardiac disability among our combat personnel. It becomes a very important factor, therefore, in the effectiveness of any task force and its recognition becomes the duty of the medical officer.

The outstanding symptoms are three:

1. Persistent tachycardia with rates as high as 140.
2. Objective palpitation or forceful beating of the apex of the heart against the chest wall.
3. Dyspnea even at rest.

In contrast to effort tachycardia the rate cannot be reduced by vagal stimulation except in slight degree. The rhythm is usually regular but occasionally extrasystoles occur. The heart sounds are of good tonal quality and easily heard over the entire precordium. Nearly all cases at one time or another present a systolic murmur of varying intensity and duration; the etiology of this murmur is not clear. It may be entirely due to the apical thrust previously mentioned, since the character of the murmur changes with posture. In phonocardiographic studies published in 1938, I believed the condition partly due to tonicity changes in a relaxed mitral ring, secondary to other psychosomatic alterations.

The cardiac phase of neurocirculatory asthenia or psychosomatic cardiopathy is usually supplemented by gastro-intestinal and central nervous system symptoms; of these pylorospasm, gastric and duodenal ulcer complaints, and irritable colon are not uncommon. General tremors, anxiety states, and emotional upsets of one type or another complete the clinical picture of the syndrome. Space does not permit an adequate discussion of the etiologic background in these cases but there is considerable experimental evidence to show that there is present in these patients a disturbed or poorly developed adrenal-pituitary-thyroid mechanism (Cannon, Crile, Libman, Oppenheimer, Wolffe).

Because the extracardiac psychosomatic manifestations of the disease may predominate, there is a general tendency to underestimate the patient's complaints and to be unsympathetic in the handling of his problems. Somehow the feeling that the individual is malingering in greater or lesser degree is usually present and scant attention is given to his symptoms until there is obvious functional breakdown. Superficially the patients in this group usually look well.

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Individuals with persistent tachycardia do not perform work efficiently; speeding up of the heart rate is accomplished only by decreasing the diastolic phase of the cardiac cycle. It is during diastole that the left ventricle of the heart is filled; if the filling time is shortened there will be a smaller volume of blood delivered to the general circulation with each contraction of the heart. The hemodynamic ratio of per minute volume output decreases considerably with rates above 132. Using the per minute volume output at 72 beats as normal, when the rate rises to 140 the output is reduced to about 78 percent. At a rate of 154 the reduction is to 71 percent; at 168 to 53 percent; finally at a 1:1 auricular flutter rate of 300 the output may fall as low as 5 percent. With the falling ventricular output there is insufficient circulation to take care of the work demand and the individual is thus unable to carry on.

Of more importance perhaps from the symptoms developed are the hemodynamic phenomena which take place in the venous side of the circulation. Simultaneously with the incomplete filling of the left ventricle there is incomplete emptying of the left auricle and subsequently a gradually increasing venous back pressure. Engorgement of the lungs takes place and later edema of the dependent parts. Congestive failure is not uncommon in these patients even after moderate exercise; marked dyspnea and basal râles may develop quickly. Pitting edema of the ankles may follow shortly.

A group of 21 patients with moderately advanced psychosomatic cardiopathy were studied to determine their fitness for heavy duty. The standard work test estimated in foot-pounds performed was used. After the equivalent of 5,000 ft.-lb. of work, 2 of these patients were forced to drop out because of breathlessness. After 10,000 ft.-lb. 6 more dropped out because of extreme dyspnea and palpitation. Eleven more patients dropped out between 12,000 and 15,000 ft.-lb. because of similar symptoms and 2 of these had signs of early pulmonary edema. The remaining 2 patients dropped out after 16,000 ft.-lb.; both had severe precordial pain and extreme dyspnea.

A group of 10 other normal young men were studied by the same tests for comparative figures; all of them reached 20,000 ft.-lb. of work without unusual cardiovascular reactions. The pulse rate response in the two groups is interesting; in the neurocirculatory asthenic patients the average pulse rate before the tests was 122 and after the tests 154. In the normal group, before the test 74 and after 96. The difference in work performance in the two groups is striking and demonstrates the importance of recognizing the condition.

I have made similar tests on other groups of patients with psychosomatic cardiopathy at home; some were made during the last war. There is a noticeable difference in the results obtained from this pres-

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ent group out here in the tropics and those obtained from the previous patients studied. The pulse rate response is much greater and the onset of congestive failure earlier in the present investigation. What is the reason for this?

The explanation probably lies in the added physiologic effect of the tropical climate, namely, exposure to prolonged heat and excessive humidity. It has long been known that cardiac cases do not tolerate heat and humidity well; several theories have been offered. Increasing the surface temperature of the body produces a general vasodilatation of the peripheral arteriolar system and greatly increases the capacity of the arterial circulation. There is thus a greater per minute volume output demand made upon the heart. Where the myocardial balance is already at a relatively low level, this additional work is performed at the expense of reserve power and in such patients this is an uneconomic functioning of the heart. Loss of water by continued sweating in the tropics is accompanied by changes in concentration of the various fluids of the body, particularly the blood and urine. These changes also affect the functional efficiency of the whole cardiovascular system. I will have occasion to speak of this again in connection with valvular heart disease.

The military importance of neurocirculatory asthenia lies not only in the large number of cases seen but in the treatment and possible rehabilitation of them. Unfortunately current medical opinion has fostered the idea that these cases are generally hopeless and should be surveyed from active service without delay. It is true that many individuals with unstable psychosomatic mechanisms lead a tortured existence from the cradle to the grave, but it is also equally true that a large percentage may be returned to useful and happy lives. In so far as military work is concerned it is possible to rehabilitate many of them.

Let us consider for a moment the mechanisms concerned in the syndrome of neurocirculatory asthenia. It has been shown that many psychosomatic reflexes can be easily conditioned; every individual has a certain emotional or psychomotor level. For example, we all react to the fear complex in a similar way or pattern, but we may differ in the degree of functional response; this response in any given case consists of a series of conditioned reflexes. This is easily illustrated; bombing from enemy planes is a common mental hazard in this area. It represents a common denominator of the fear complex in all. The first experience in a foxhole during a raid is naturally terrifying and the psychosomatic reactions of palpitation, breathlessness, tremor, dry mouth, and gastro-intestinal irritability are all of a part of the adrenal-produced fear complex. These symptoms ordinarily last only for a short while and disappear almost entirely when it is realized that no

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harm has been suffered. The fact that one is aware that no harm has been suffered is a sufficient neutralizing stimulus to stop most if not all of the psychomotor symptoms. Where, however, there is a poorly developed or disturbed neutralizing mechanism, the original symptoms will persist for long periods of time. This, in a crude explanatory way, is the underlying problem in neurocirculatory asthenia.

The treatment of the condition must, therefore, employ methods to re-establish normal neutralizing mechanisms or reflexes. This is not impossible, and in the hands of a sympathetic and understanding medical officer many of these patients can be restored to usefulness. If considerable time has been given to this group of patients, it is because I believe that it has not received the attention it merits both in military and civilian life; patients with neurocirculatory asthenia constitute the largest single group of individuals with cardiac disability in whom, paradoxically enough, there is usually no organic heart disease at all. In the tropics under combat conditions it seems to appear in its greatest frequency; it is here that these cases should be studied and treated.

IRREGULARITIES OF THE HEART

About one-fourth of all cases seen in cardiac consultation in this study had irregularities of the heartbeat; this is slightly higher than a comparative group (21 percent) in civilian practice. The breakdown of the figures is interesting and I shall have a word to say about the various groups.

Extrasystoles.—The largest group of the irregularities were due to extrasystoles or premature beats (17 percent). These were chiefly ventricular in origin and followed the familiar vagal-respiratory pattern; there were a fair number of extrasystoles with the ectopic focus arising in the auricles and there was one case with a prolonged series of nodal extrasystoles. Electrocardiographic facilities in this area while somewhat limited were freely used to determine the cause of any irregularity if it could not be diagnosed clinically. Most extrasystoles can be detected by the ordinary methods of examination; where they are occurring very rapidly and producing a rather irregular pulse, it may be difficult to distinguish this rhythm from auricular fibrillation. The differential diagnosis is simplified by the electrocardiograph.

Patients with extrasystoles usually complain of heart consciousness; this may be just a mere awarenes of the heart's activity or extreme palpitation with painful contractions of the heart. Most individuals with extrasystoles are worried about them and their possible significance in relation to heart disease. Fortunately most premature beats have little or no clinical significance; the only exceptions are those

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occurring during episodes of acute coronary thrombosis. These will be discussed later.

Treatment of extrasystoles is based largely on the removal of vagal irritating factors; excessive smoking or coffee drinking, flatulence, hyperacidity and other gastro-intestinal conditions, sinus disease, foci of infection, etc. There is no specific medication; digitalis and quinidine should not be given. Sedation with phenobarbital is sometimes useful; I have found its combination with belladonna and theobromine sodiosalicylate to be helpful in many stubborn cases.

Of great importance is the reassuring of the patient that the condition is not serious; sometimes this alone may be sufficient. Extrasystoles rarely cause cardiac disability and individuals with this complaint can be safely returned to active military duty.

Paroxysmal auricular fibrillation.—Paroxysmal auricular fibrillation occurred in 3.5 percent of this series; all were in young adults without obvious signs of heart disease. The onset of the episode was typical in all cases; pulse rates were rapid and grossly irregular (180 to 212). The attacks lasted for a few minutes up to 3 hours; only one patient had a second attack while under observation. Nearly all gave a history of performing hard physical work under tropical atmospheric conditions, temperatures averaging 105° F. and humidity nearly at saturation point.

Paroxysmal auricular fibrillation with no underlying cardiac damage has been frequently described in young adults; ordinarily the prognosis is good and there is no permanent disability. Repeated attacks are rare but if they do occur the condition is most likely due to undiscovered rheumatic mitral lesion.

The hazard in this group, as in all fibrillators, is due to the formation of mural thrombi in the walls of the auricles during the period of fibrillation; when normal sinus rhythm is restored, the initial forcible contractions of the auricular musculature tend to break off or dislodge the thrombus formations and emboli are forced into the circulation. From the right auricle such emboli may go to the lungs causing infarction; from the left auricle the emboli can pass to any part of the arterial tree.

An established diagnosis of paroxysmal auricular fibrillation should be sufficient to survey an individual from active military service, especially if there has been more than one attack. The electrocardiograph where available should be used in doubtful cases; rapidly recurring extrasystoles must be ruled out.

Persistent auricular fibrillation.—In this group there were only 2.5 percent found with continuous fibrillation. In nearly every instance underlying cardiac disease could be determined; the most common single cause was rheumatic mitral stenosis. A few aortic valvular

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lesions were also found. Most of these individuals were discovered only when congestive failure developed, usually pulmonary edema. Duration of fibrillation could not be determined in most instances; all of the patients had sinus rhythm on the last routine examination. It is astonishing how much physical work can be performed without disabling symptoms by patients with mitral stenosis in the prefibrillation period; this in contrast to the limitations which follow soon after auricular fibrillation occurs.

Auricular fibrillation of the continuous type is practically always the result of heart disease; the exceptions are rare. When discovered such cases should be promptly surveyed from active military service; it is a serious form of cardiac disability.

Paroxysmal tachycardia.—This condition is relatively uncommon even in civilian cardiac clinics; it occurred in 2 percent of the cases seen here. In all but one case there was considerable heart damage present, usually old rheumatic pathology or coronary disease. The characteristic symptom of the condition is the very high pulse rate; in these cases the rates ran from 200 to 240. The attacks usually begin and end abruptly and may last for a few minutes up to days. The longer the attack, the greater the danger of acute congestive failure. In this group the attacks did not last very long; in one patient the episode lasted 4 hours, another case was complicated by an old asthmatic condition, and there was one hypertensive individual (232/114) who went into pulmonary edema during the attack.

Intravenous aminophylline was used successfully in three instances and strophanthin in one. There was no mortality in this group. The very rapid heart action, while characteristic, must sometimes be differentiated from paroxysmal auricular fibrillation with high pulse rates as well as from rapidly developing extrasystolic arrhythmias. Here again the electrocardiograph is valuable.

The hazards of this condition are the same as in paroxysmal auricular fibrillation; mural thrombosis and subsequent embolization as well as acute congestive failure. Patients with this disease should be surveyed from military service.

Heart block.—Heart block was seen only in a few instances (0.5 percent). One was a lad of 19 years with a pulse rate of 44; there was no change in rate after exercise. He had a definite history of rheumatic fever at the age of 15 years but there were no signs of valvular involvement. He was evacuated from an active combat area after he had suffered a "blackout"—a period of unconsciousness for about 1 hour. A paroxysmal heart block was seen in a grounded aviation mechanic, also with a rheumatic history. All of the cases but one were complete heart block—auricular and ventricular dissociation.

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There is no effective treatment for heart block; the background of the condition is usually rheumatic in the younger and coronary disease in the older age groups. One patient with heart block had diphtheria. These must be surveyed from active service.

Miscellaneous cases.—There was a small group (0.5 percent) of miscellaneous cases with unusual irregularities of the heart. A few of these will be mentioned; auricular flutter with a 4:3 rhythm, wandering pacemaker (incomplete), postdengue bradycardia, nodal tachycardia, and bundle branch block. All of these irregularities were associated with other types of cardiac pathology and all represent serious disease of the heart; they should be surveyed when discovered.

VALVULAR HEART DISEASE

The discovery of valvular heart disease in 20 percent of the cardiac cases under study comes as no surprise. All of them existed prior to enlistment (EPTE) and in many instances some were of long standing. During the hectic recruiting days of 1941 and early 1942, thousands of young men were able to receive only the most superficial physical examination; this is in criticism of no one and no branch of the military services. At that time there were just not enough doctors or medical personnel to carry out the huge task of examining millions of candidates. The result was that only the most obvious defects could be detected.

The examination of the cardiovascular system, while a relatively simple and routine procedure, requires more time and mental concentration than could be afforded to any one individual candidate for enlistment while a hundred others stood impatiently in line. In order to listen to heart sounds and murmurs intelligently, the examiner must have a quiet, warm but well ventilated room and he must be free from all other demands on his attention at that moment. Contrast this type of examination with one made in a large, cold, draughty armory or barracks with all of the noise and distractions arising from a thousand sources. That murmurs of the heart went unrecognized is not to be wondered; the amazing thing to me is that so few cases slipped by, but these are the very ones which are now turning up in every medical facility. They will continue to increase in number and will constitute a difficult problem.

About 20 years ago I wrote a paper upon "Asymptomatic Heart Disease"; I have always believed that the subject was not sufficiently appreciated by medical men. I am still astonished at the amount of work which can be performed by patients with extensive heart damage and I am still in awe of the individual who suddenly drops dead with a rather normal cardiovascular system. Sooner or later, how-

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ever, the patient with heart disease does present symptoms but at that time the damage to the myocardium may be irreparable.

This is particularly true in adolescent rheumatic heart disease; it has not been an uncommon experience to pick up cases of advanced valvular pathology among athletic squads of secondary schools and colleges. Some of these young men have attained high standing in competitive sports in spite of an inadequate cardiovascular system. Breakdown usually follows a mild or generally insignificant infection, frequently of the upper respiratory type. At that time there are advanced signs of heart damage; enlargement, congestive failure, arrhythmias, and possible subacute bacterial endocarditis.

This story has been repeated time and again among the patients admitted to the cardiac clinic in this series. Nearly all present clinical signs and symptoms of advanced valvular heart disease; many have loud murmurs. These are chiefly systolic in time, but there was a large group of presystolic murmurs. Only a few diastolic aortic murmurs were discovered. In practically every case a history of a previous attack of rheumatic fever could be elicited if the patient was questioned closely enough. Many volunteered the information that they had been bedfast for several weeks or months as a child with "heart fever"; some knew they had a "weak heart" when they were very young or they had been told about a "heart murmur." Few seemed to be surprised to learn that there was something wrong with their heart. In short, with rare exception, every one of these cases could be established as having existed prior to enlistment. This brings us back then to the original recruiting examination and the lesson learned from our experience here: These young men should never have been accepted for military service!

Let us consider the events leading up to the break-down of the cardiovascular system in these cases; they all follow a characteristic pattern already familiar to us in the athletic group of missed rheumatic hearts:

1. Exposure to tropical climate with excessive heat and humidity.
2. Exposure to a very rugged type of existence.
3. Exposure to the exhausting kind of physical exertion necessary for combat duty.
4. Exposure to general infection—malaria, dengue fever, dysentery, acute infective jaundice.

Any one of these hazards or any combination of them might easily be sufficient to throw a poorly balanced cardiovascular system into failure.

The signs of circulatory break-down usually occurred in the following order:

1. Dyspnea on slight exertion or even at rest.

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2. Edema of the lower legs and ankles at the end of the day.
3. Easy fatigability.
4. Inability to concentrate on complicated tasks.
5. Loss of manual precision.
6. Gastro-intestinal complaints with anorexia.
7. Loss of weight—sometimes concealed by increasing edema.
8. Palpitation on moderate effort.
9. Paroxysmal coughing, sometimes with hemoptysis—usually mistaken for pulmonary tuberculosis.
10. Congestive failure with pulmonary edema, enlarged liver, and ascites.

Treatment of these patients is simple and differs in no way from the civilian handling of congestive failure in valvular heart disease. The problem from a military standpoint is to discover these cases before they go into cardiovascular break-down; this can only be done by a constant checking and rechecking of all personnel under the care of each medical officer. In the expenditure of time and effort, preventive medicine lags far behind therapeutic medicine on nearly every front, but it seems to me that it would not be difficult to strike a better balance if every medical officer thoroughly understood this problem and its implications.

I have not seen a single case of primary acute rheumatic fever in any naval personnel during their service in this area; there have however been a few secondary episodes in lads exposed to adverse conditions such as prolonged immersion in sea water. In these latter cases all had a previous history of rheumatic fever, sometimes two or more attacks before enlistment. I do not hestitate to say that the discovery of valvular heart disease in these young men is sufficient evidence that it existed before they reached this area and in most instances before they enlisted.

The number of patients with valvular heart disease among these men will continue to increase as the war continues and as more and more of the original missed cases seek medical attention; the total number of cases is difficult to estimate but regardless of the figure it is still not too late to do something about it. The answer lies in the hands of each medical officer and the care which he uses in finding the remainder of these missing cases; they can and must be discovered!

CORONARY HEART DISEASE

In the World War I coronary heart disease was still almost unknown in the Navy; the average age level of the combat personnel was in the relatively young age group. The number of older officers and CPO's was insignificant compared to the large mass of young adults. With the recent introduction of construction battalions the average

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age level of Navy personnel has risen considerably. It is no military secret to say that there are many men in the forties and fifties in every Seabee unit. The problem of coronary heart disease has accordingly become one of the important groups in this study; they number 11 percent of this series.

Construction battalion work, as the name implies, is largely physical labor; the tasks performed by these units is one of the epics of this war. They have literally torn down mountains and changed the course of rivers; they have transformed the topography of many a South Sea island. All this has been done by a remarkable organization of middle-aged volunteers, skilled artisans of every kind. Many are doing work of an unaccustomed type or of a more strenuous nature than in civilian life. It is little wonder, therefore, that in some of these the aging cardiovascular system is unable to cope with the strains now placed upon it. Add to these unusual physical demands, the effect of tropical climate with prolonged exposure to heat and humidity, and the background for episodes of atherosclerotic cardiovascular disease is set.

The mode of onset, course of the acute coronary attack, and the convalescent period have not differed materially from cases seen at home. The pathology appears to be the same and we have learned nothing new either in diagnosis or treatment. It might be well to discuss the symptoms of the condition. Fatigue and dyspnea appeared early in these men; gastro-intestinal complaints, dizzy spells and headaches were common. Of great importance is the appearance of pain over the heart or substernal area; this is a serious symptom and should not be considered lightly. When a man who previously has been working hard over a long period of time and who has been without symptoms, suddenly complains of heart pain, the condition warrants a careful examination with free use of the electrocardiograph, x-ray, and all other laboratory facilities.

Much has been written about the prevention of acute coronary occlusion; many authors feel that little or nothing can be done. I have always disagreed with this opinion and I believe that many individuals may be spared from the hazards of a coronary attack and perhaps from too-early death itself provided attention is given to the very early manifestations of the disease. Prevention of an attack depends upon the prompt removal of the factors responsible for the prodromal symptoms of the condition and the proper evaluation of all of the patient's complaints. In the group under discussion, no less than a complete examination from every possible angle must be undertaken when the symptom complex is even remotely intimated, i. e., whenever heart pain, dyspnea, and substernal distress bring the patient to the clinic.

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A patient with coronary disease should, of course, be surveyed from active military service. When the electrocardiogram and other laboratory tests are confirmatory the diagnosis is simple. There is a considerable number of cases, however, in which the diagnosis must be made from presumptive evidence and with more or less negative physical and laboratory findings; these challenge the scientific skill and experience of the medical officer. Sudden death may be just as frequent in these latter cases as in the former. It is better to make the diagnosis too often than to let a single case slip by unrecognized.

Not all cases of coronary heart disease came from the naval construction battalion group; retired personnel of all classes who have returned to active military duty have contributed their share. Here the age periods are somewhat higher—from 45 to 60 years. The inciting factors are slightly different from those in the Seabee units: there is less physical labor but more psychic and emotional stress. Fleet combat duty can be productive of considerable psychosomatic strain, and just as a chain gives way at its weakest link, so will a cardiovascular system weakened by the degenerative changes of the aging process tend to break down under such conditions.

I would like to leave this subject with an optimistic note. It is my impression, unsupported by any actual statistical data, that the incidence of coronary heart disease in the Navy is considerably less than in an equal group of middle-aged men living under conditions of city life with its toll of emotional strain from everyday business, financial, and family burdens. Life in the Navy, and I am speaking now of the South Pacific, may be rugged but it is conditioned by a systematic routine of existence which I believe is chiefly responsible for the postponement of most atherosclerotic symptoms.

Finally, a word about the effects of the tropical infectious diseases like malaria, dengue fever, acute infectious jaundice, filariasis, and dysentery. I have observed no ill effects reflected upon the middle-aged heart and blood system in the acute or subacute stages of these infections except in rare instances; naturally we have not had the opportunity to follow these patients over a period of many months or years but there is no reason to believe that there is any special hazard to any of us in this age group who have had one or more attacks of these tropical infections. I mention this particularly in answer to the current belief that malaria predisposes to degenerative changes in the aorta; there is no pathologic confirmation of this.

HYPERTENSIVE HEART DISEASE

Blood pressure with systolic levels over 145 and diastolic over 100 was found in 6 percent of the patients studied in this series. These were about equally divided between the juvenile types of hypertension

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and the middle-aged group. The total number of patients was far less than anticipated according to the psychosomatic theory of hyperpiesia.

In the younger age group, from 18 to 25 years, the condition was found associated with other signs of neurocirculatory asthenia; a few had overactive thyroid syndromes. There was a larger group, however, with no such abnormalities. I have previously reported a large series of these cases picked up from the recruiting service. This condition, like neurocirculatory asthenia, is known under many names in the literature of the subject; essential hypertension, idiopathic hypertension, adolescent hyperpiesia, and functional thyrotropic pituitarism (Cushing). In World War I, Brooks followed a group of these young men for several years; in many instances the blood pressure returned to normal but in a few cases there was a fatal outcome with cardiovascular-renal complications. I hope that I may have an opportunity of following these present cases. In the meanwhile, I do not believe that they are fit for active military duty. The condition can usually be established as EPTE. On evacuation to noncombat or more temperate climate areas a few may clear up, but in general the pressure levels remain elevated for some time. I can recommend no drug therapy.

The older age group presented the clinical picture of hypertension differing in no way from those cases seen in civilian practice. In nearly all there was an associated cardiovascular problem; some had kidney complications. Many came from construction battalion units and the condition was obviously present before enlistment. These cases should be surveyed from active military service; the hazards of cardiovascular-renal breakdown are naturally much enhanced by combat duty. Other cases of hypertension occurred in personnel who had been in the service for many years; under the circumstances they should be transferred to noncombat duty, preferably away from the war zone. Some of these are capable of many more years of useful service in positions where their special experience and training may be employed.

VASCULAR DISEASE

Only 3 percent of the entire series of cardiovascular cases presented here had demonstrable vascular disease; there are probably many more but they have remained undiagnosed. Most of these have been in the older age groups and the peripheral vascular system has been involved. The most frequent site has been in the lower legs and feet. Intermittent claudication after long marches brought many to the clinic. Thermal hyperesthesia of the feet—both in the hot and cold phases—was common. The dorsalis pedis tests in these cases usually showed obstructive changes in peripheral blood flow. There was only one case of true endarteritis obliterans; this with an EPTE history.

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Disease of the aorta was not a common finding in this group; the x-ray diagnosis was only made three times although symptoms were present in many more instances. One case of early luetic aortitis was observed.

There was a small group of younger patients with symptoms of Raynaud's disease, usually of the hands and fingers. One lad had the typical "snow fingers" described by Reisman. None of these were incapacitating in tropical climate and the subjects all returned to duty.

On the venous side of this vascular group of patients, there were comparatively few cases of varicose veins of the leg. This condition is easily recognized at the recruiting examination and only a rare case slips by. I would say that when found within a year after enlistment it was probably EPTE.

There were two cases of arteriovenous aneurysm, both the result of accidental injury; one was in the cubital space and the other in the upper thigh.

SUMMARY

1. An opportunity has been presented here to observe a rather large series of cardiovascular patients seen under active combat duty and exposed to the heat and humidity of the equatorial tropics. In a general way, the various groups of cardiac cases have not differed materially from similar patients seen at home.

2. Neurocirculatory asthenia or psychosomatic cardiopathy was responsible for the largest number of patients. The condition was nearly always EPTE. Exposure to the heat and humidity of this area has aggravated the symptoms of the disease. Those patients are unfit for tropical combat duty. Many of them can, however, be rehabilitated for service elsewhere.

3. Irregularities of the heart is the next most common group. The extrasystolic arrhythmias are not incapacitating. All other irregularities—paroxysmal auricular fibrillation, persistent auricular fibrillation, paroxysmal tachycardia, and heart block—represent serious diseases of the heart and such patients should be promptly surveyed from active military service. The condition is frequently EPTE.

4. Valvular heart disease fares poorly in the tropics. All of the cases observed were rheumatic in origin. All existed prior to enlistment; they represent the "missed cases" of the early recruiting days. They should be surveyed from the service.

5. Coronary heart disease is largely a problem of the construction battalion units because of the higher age periods in this group. Hard physical labor and exposure to the heat and humidity of this area has accelerated the degenerative cardiovascular process. The condition in all cases existed in a subclinical or prodromal state prior to

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nlistment. It is aggravated by tropical construction battalion work. stablished cases should be promptly surveyed.

6. Hypertensive heart disease was not common in spite of the fac-rs of tropical combat duty. There are two distinct types; juvenile nd middle age. There may be an EPTE history in all cases. Except n cases with a long service record, all should be surveyed from active uty.

7. Vascular disease is uncommon; it appeared chiefly in the con-ruction battalion group. Peripheral vascular complaints appeared fter prolonged muscular exertion. There were a few juvenile types f circulatory disease which were not disabling.

8. Prevention of cardiovascular break-down in all of the cardiac roups is possible, and is emphasized particularly in the valvular and oronary heart disease cases.

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PLATYPHYLLIN

In the laboratories of the All-Union Chemical and Pharmaceutical Institute there was discovered a new alkaloid to which the name of platyphyllin was given. The alkaloid, the formula of which is $C_{18}H_{23}NO_5$, is obtained from the herbs and roots of *Senecio platyphyllus*. Platyphyllin in the hydrochloride or tartrate form is a white crystalline powder freely soluble in water at room temperature. Solutions of the same are colorless with a slightly astringent taste, which retain their potency for a long time when kept sterile. Platyphyllin resembles the alkaloids of the atropine group but differs from atropine in that its action is weaker and less prolonged.

Platyphyllin was found to excite the central nervous system, the larger the dose up to the toxic limit, the greater the excitation. Platyphyllin affects the circulation chiefly by inducing a fall in blood pressure. It stimulates the respiratory center, producing deeper and more frequent respiration with the fall in the blood pressure cycle.

When studied on the intestinal tract, this drug is found to relax the tonus and peristaltic contractions of the guts, due apparently to its effect on parasympathetic nerve endings and not to an action on the muscle cells themselves.

Preparations of platyphyllin are well tolerated over long periods of time when administered either by mouth or hypodermically or in the form of suppositories. Platyphyllin does not have the disagreeable byeffects produced by atropine.

Platyphyllin appears to be a good antispasmodic in diseases of the abdominal organs, its antispasmodic action being superior to that of atropine. Playtphyllin in therapeutic doses has no effect on the heart action or on the conductivity.—Goldenhershel, I. I.: A new atropine-like substance called platyphyllin. Klinicheskaya meditsina 31: 56–61, 1943. (Macht, D. I.: Abstract. Am. Rev. Soviet Med. 1: 155–157, December 1943.)

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STUDIES IN WEIL'S DISEASE

GEORGE LORENZ, JR.
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During the months between December 1940 and March 1941, five cases of jaundice in which a spirochete was found in the blood and identified by the laboratory as the Leptospira icterohaemorrhagiae were observed at this hospital. Upon this recognition the diagnosis of Weil's disease was made. In none were the various confirmatory tests performed; i. e., agglutination (*1*), adhesion (*2*) nor the criteria described by Bergey (*3*) in his manual.

About 1 year after these patients had been discharged from the hospital, an attempt was made to obtain blood samples from each in order further to substantiate the diagnosis, since Fairley (*4*) and Schüffner (*5*) were able to demonstrate the presence of agglutinins in the blood for as long as 8 to 12 years after recovery from the disease. In only one instance was there a response to the request, but, upon the receipt of that sample, it was found that the blood had hemolyzed, thereby precluding any further studies.

In reviewing these case histories, certain inferences may be drawn and evidence established, corroborating the records of several investigators in this field.

Among these are the apparent world-wide distribution of leptospirosis along with only the occasional and infrequent clinical manifestation of Weil's disease in man. This human susceptibility may well parallel the frequency with which this infection is encountered in animals. In a survey of how often leptospirosis was found in trapped rats in Philadelphia in 1939–40, only 11 of 100 wild rats (Mus norvegicus) were proved to be carriers (*6*). Apparently the same proportion of European rats are infected as are the American (*10*).

A report by Larson (*7*) in 1941, upon the incidence of Weil's disease in Puerto Rico and the United States, revealed the total number of both proved and presumptive cases to be only 98. There were 14 states represented along with Puerto Rico and the District of Columbia. The greatest number of cases in any one state was 13: in Puerto Rico, only 5; and the District of Columbia, 2. It could be inferred that Weil's disease is nonexistent, or at least is not recognized in the states not represented in the report. Walch-Sorgdrager (*8*) lists 46 countries in which the disease is recognized. Oddly

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nough, a series of cases usually follow from a community after the re-ort of a single case. Ashe et al. (*9*) state, "In our study of this dis-ase, we have been gratified to find that, after the identification of the rst case, the Hospital Staff has been able to make the clinical diagnosis f Weil's disease with comparative ease," insinuating one of two pos-ibilities: That the disease could be epidemic or that the citing of he original case has brought cognizance of the disease.

The group included in this series tends to confirm the wide dis-ribution of Weil's disease and also would lead to the following onclusions:

1. That all persons who may be exposed do not become infected.
2. That there is a natural immunity enjoyed by the majority.
3. There are many individuals who, even though infected, fail to how clinical evidence (jaundice).

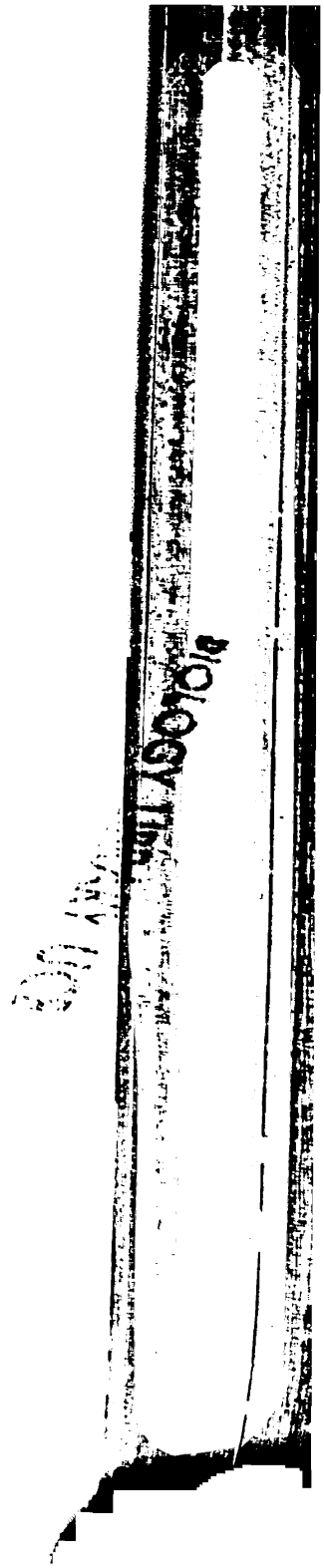
The consensus is that the mode for transmission of Weil's disease s through materials which have come in contact with the excreta of nfected rodents and it is reasonable to suppose more than one person vould come in contact with the same contaminated material (*10*) hus opening a field for an epidemiologic investigation by examining very person who may have been in contact with this infected material.

All of the cases under discussion were active naval personnel coming from different naval activities.

One patient noted symptoms while traveling from the west coast, wo were from separate ships, one was on a receiving ship, and one from a naval hospital where he was serving as a hospital corpsman.

The course and symptoms of the disease followed the usual textbook lescription and, in particular, the incubation period (*10*) extending from 3 to 21 days—with an average of about 11 days. In two cases the initial symptoms were somewhat similar although the incubation periods were different. In the case of the corpsman, symptoms char-acteristic of acute catarrhal fever were present to so great a degree that he was admitted to the sick list under that diagnosis for 6 days and then discharged. Four days later he first noticed jaundice. Another was also admitted under the same provisional diagnosis but developed jaundice about 2 days after admission. In one instance, the first symptom noted was "rawness and soreness" in the chest; in the remaining—jaundice and hives in one, and nausea and insomnia in the other.

The following symptoms in order of frequency were outstanding and occurred in all cases: Nausea, acholia, jaundice and liver enlarge-ment (2 to 3 fingers below rib border). Malaise and anorexia were present in three, two vomited, while the following occurred only once: Insomnia, urticaria, pain in the right upper quadrant, headache, diarrhea, and sore throat. In none was the spleen palpable.



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DISCUSSION OF THE OUTSTANDING LABORATORY FEATURES

Leptospirae were found on the first darkfield examination in all but the last patient, in whom they were demonstrated after 5 days' hospitalization.

Prothrombin time was increased in two of four cases examined, and in one was 45 percent of normal and in the other 64 percent. This improved as recovery progressed. (One patient vomited some blood-stained fluid.)

Jaundice was measured in degree after the usual manner of icterus index. The most profound index was 120; in two cases the jaundice deepened after 10 days of illness, gradually tending to diminish. All four patients who recovered were discharged before the icterus index became normal.

Blood sugar.—Where this procedure was performed the trend was toward hypoglycemia and in one instance fell as low as 42 mg. per 100 cc.

Cholesterol.—In only one patient was this over 200 (206) and the others varied from 83 mg. to 181 mg.

Gastric analysis failed to reveal any particularly significant features.

Gallbladder visualization was carried out in four cases. In three cases this organ failed to visualize and one was reported as a "normal functioning gallbladder."

Kahn in all instances was negative.

The *liver function test* used in this series was the bromsulfalein and in all patients there was evidence of retained dye, varying from 5 to 100 percent.

Urine.—In none of these cases were leptospirae found in the urine, quite possibly because the urine in each instance was acid in reaction and it has been shown that in order to demonstrate the organism, the urine must be either neutral or on the alkaline side (*6*).

TREATMENT

All cases were treated by one or more injections of mapharsen, the average injection being .06 mg. Three cases received 2 injections each and one had only a single dose. Two of these patients required a second dose while two failed to show spirochetes after the original injection.

A summary of the 5 cases is found in table 1.

As there was only one fatality and since the course of four of these patients was similar, ending in recovery, detailed clinical reports of these are superfluous. The fatal case is presented in detail along with postmortem findings because of its variation.

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TABLE 1.—*Summary of the 5 cases*

	Symptoms noted	Jaundice noted	Liver	Spleen	RBC	Hb	WBC	Urine	Leptospirae	Mapharsen	Icterus index
CASE 1. Admitted 12/21/40.	Jaundice. Urticaria. Nausea. Acholia.	12–21–40	3 f. below, not tender.	Not palp.	5.01	15 mg.	5,15 Band. 3%. Seg. 53. Lymph. 36. E. 2. M. 6.	Sp.Gr. 1.017. Acid. Neg.	1–7 many 1–14 neg. 1–27 neg.	1–7 0.06 mg. 1–14 0.06 mg.	1–4 53.3 1–14 70 1–21 45 1–28 29
CASE 2. Admitted 1/16/41.	Malaise, 3 weeks. Nausea. Insomnia. Anorexia.	1–15–41	3 f. below, not tender.	Not palp.	4.75	13.5 mg.	12.8 Band. 7% Seg. 59. Lymph. 26. M. 8.	Sp.Gr. 1.022. Reaction acid. Otherwise neg.	1–20 many 1–24 many. 1–31 none.	1–20 0.06 mg. 1–27 0.06 mg.	1–21 120 1–28 93 2–4 28 2–8 35 2–13 22
CASE 3. Admitted 1/8/41.	Cat. fever. Hospitalized 6 days Nausea. Vomiting. Loss appetite. Acholia.	1–8–41	2 f. below, not tender.	Not palp.	3.60 1–13 3.70 1–27	13.5 mg. 12.5 mg.	5.6 Band. 6%. Seg. 44. Lymph. 40. M. 10.	Sp.Gr. 1.012. Acid. Neg.	1–13 many 1–20 many. 1–31 none.	1–14 0.03 mg. 1–25 0.06 mg.	1–11 40 1–21 60 1–28 23 2–4 28 2–8 16
CASE 4. Admitted 1/17/41.	Cough. Chilly. Febrile 4 days. Anorexia. Acholia. Nausea. Pain r. hypoch.	1–20–41	3 f. below	Not palp.				Sp.Gr. 1.025. Acid. Neg.	1–21 many 1–30 none.	1–27 0.06 mg.	1–21 30 2–4 20 2–8 12
CASE 5. Admitted 3/8/41.	Sore throat. Malaise. Headache. Vomiting. Slight diarrhea. No jaundice.	3–10–41	3 f. below	Not palp.		13 mg.	11,000 Band. 12%. Seg. 67 Lymph. 18 M. 3	Alb. 4+ Gran. cast Pus 4–8 HP Acid.	3–11 neg 3–13 pos. 3–14 pos. None in spinal fluid.		100

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TABLE 1.—*Summary of the 5 cases*—Continued

	Prothrombin	B. S. P.	Van den Bergh	G. A.* hyperacidity	Drainage	G. B. U.	B. sugar	Cholesterol	Kahn
	Percent								
CASE 1. Admitted 12/21/40.	1-6 45 1-13 70 1-28 88	5% dye retained in 30 min. 1-30.	----------	33 23 44 32 47 46 63 46	1-6 Calc. Bact. 4+ 1-14 Bact.	Failed to visualize 1-8.	1-6 42 mg. 1-29 72 mg.	1-6 174 mg. 1-29 83 mg.	Neg.
CASE 2. Admitted 1/16/41.	1-20 94 1-27 94	40% dye retained 30 min. 1-30.	----------	62 64 61 47 77 81 74 63	1-17 Vomited.	Failed to visualize 1-18.	1-24 70 mg.	1-24 206 mg.	Neg.
CASE 3. Admitted 1/8/41.	1-28 88	15% retained 30 min. 1-30	----------	51 36 46 29 66 51 62 43	1-10 Light Green. 1-21 Many bact.	Normal functioning, G. B., 2-5-41.	1-29 66 mg. 2-5 70 mg.	1-29 155 mg.	Neg.
CASE 4. Admitted 1/17/41.	1-21 64	----------	Immed. dir. 4.9 mg.	51 54 50 52 75 81 79 84	1-20 Green. 1-25 Brown.	Failed to visualize 1-22.	----------	1-24 145 mg.	1-20± Spinal 1-23 neg. 2-10 Kahn neg.
CASE 5. Admitted 3/8/41.	----------	100% retained dye.	----------	Pos. for blood	----------	----------	----------	181 mg.	Neg.

* Figures here are based on fractional gastric analysis using 5% alcohol, the first number representing the degrees of total and free acid in the fasting contents, the remainder the acid values at ½-hour intervals.

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CASE REPORT

A ship's cook, first class, age 41 years, at the onset of his illness complained of a sore throat, generalized malaise, headache, sensation of a lump in his chest, and vomiting. There was a loss of appetite and diarrhea. The stools were of watery yellow character.

The physical examination revealed an injected and swollen pharynx with the anterior cervical lymph glands swollen, tender, discrete, and freely movable. The chest revealed transient râles. The blood pressure was 140/90 and the pulse was 130.

Blood examination showed 11,000 leukocytes with a normal differential and 13 mg. hemoglobin. Urinalysis was positive for albumin, and a few granular casts with 4–8 leukocytes found on microscopic examination. The stool was strongly positive for occult blood. The icterus index was 100 while in the bromsulfalein test practically 100 percent of the dye was retained at the end of 30 minutes. The cholesterol reading was 181 while a few spirochetes morphologically resembling leptospirae were noted. The spinal fluid was free of organisms, the globulin test showed a very slight increase. The colloidal gold curve read 1111000000.

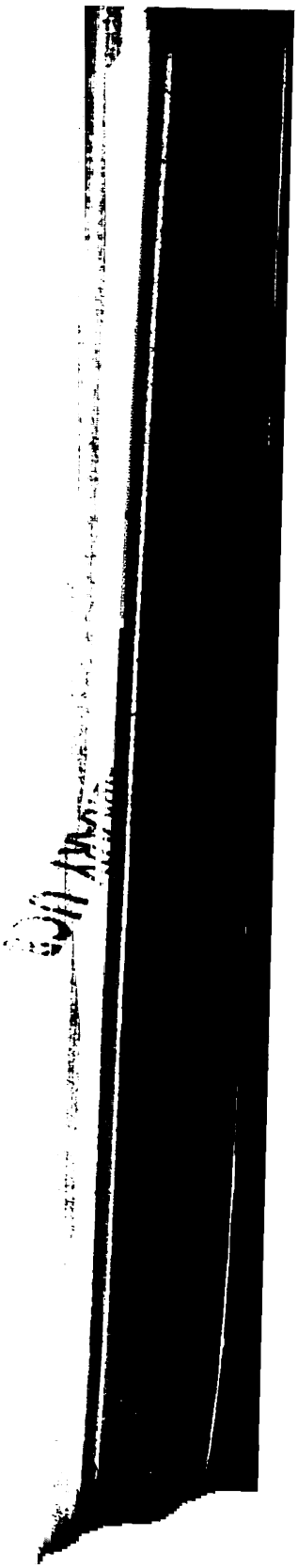
The autopsy findings were irrelevant except for the liver, sections of which showed very extensive necrosis, only the periportal parenchyma being spared. The necrotic areas contained many pigment and filled cells, lymphocytes and mononuclears. Portal branches were thrombosed. Thromboses were likewise found in the spleen, kidneys, and pancreas.

CONCLUSIONS

1. Weil's disease has a world distribution.
2. The incidence of Weil's disease is probably greater than reports would indicate.
3. Liver damage is profound.
4. Careful epidemologic surveys should be conducted immediately following the report of any case of Weil's disease.

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HYPERVENTILATION SYNDROME

Any normal person readily can experience the symptoms of hyperventilation by voluntary forced breathing. It is only necessary to force maximal inspiration and maximal expiration at an approximately normal rate. Within 30 to 60 seconds an odd sense of faintness and dizziness is noted. True rotary vertigo is not present, but an unsteadiness described as a "lightheaded" feeling is experienced. Within a minute or two a characteristic numbness and tingling type of paresthesia will be noted in the extremities and a sense of panic and palpitation are evident. The mind becomes clouded; surroundings take on an appearance of unreality and the person borders on unconsciousness. If the forced breathing is continued for five minutes or more, the muscles may become perceptibly tense and eventually the tetanic contractions of carpopedal spasm will ensue. In later stages a sense of air hunger may be experienced even during hyperventilation tending to produce a vicious circle. If forced breathing is continued, state of vasomotor collapse resembling shock may be produced. The pulse is weak, rapid and irregular and the skin is pale, cold and moist. The patient is in a state of extreme anxiety and often lapses into semiconsciousness.

These more violent manifestations are rare in clinical practice and occur only among frankly hysterical patients, but the milder sensations are common. Patients describe a feeling of constriction in the thorax, a sense of inadequate ventilation associated with dizziness, faintness and anxiety; when prolonged, the highly characteristic tingling and numbness of the extremities are present. Usually the patient does not know that he is hyperventilating, but in the more severe instances even an untrained witness may observe and report it.

The diagnosis is established by instructing the patient to hyperventilate in unison with the examiner for a minute or more, timed with a watch. Identical sensations are experienced by both doctor and patient, and the patient recognizes the sensations as those of his attack.

A few minutes of controlled respiration yields complete relief.—Hinshaw, H. C.: The syndrome of hyperventilation; its importance in aviation. Proc. Staff Meet., Mayo Clin. **16**: 211–213, April 2, 1941.

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MUMPS MENINGO-ENCEPHALITIS

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Mumps ranks first in the incidence of contagious diseases treated at this hospital and irrespective of its association as a disease of early childhood it must be considered as always endemic in naval personnel. Further, while there is an increasing study and knowledge of many of the encephalitides and benign meningitides, the existence of neurologic complications in mumps is not widely appreciated. In the past 5 months we have seen 10 cases of mumps meningo-encephalitis in a total of 165 mumps admissions, representing a morbidity rate of 6 percent. This relative frequency as well as the inadvertence of such complications generally, prompts this report.

Historically, the first recorded observation of mumps meningitis was made by Hamilton (*1*) in 1790. During the nineteenth century, descriptions of this complication were made by a number of European authors (*2*) (*3*) (*4*). Monod (*5*) in 1902 reported the first spinal fluid examinations made in mumps meningitis. Many articles have since appeared, the largest group consisting of 38 cases in children, reported by Birnberg (*6*) in 1939.

The cases here discussed are perhaps best termed meningo-encephalitis. Although meningeal or encephalitic symptoms may variably predominate, it would appear neither advantageous nor always possible accurately to localize the pathology. In general, the reported cases in the literature, as well as the cases observed here, indicate a predominance of meningeal rather than encephalitic symptoms.

The literature relative to the comparative incidence of neurologic complications of mumps is rather misleading. Reports indicate an incidence varying from 0.1 percent to as high as 10 percent. Since mumps cases are often never reported and since, in general, mumps meningo-encephalitis is not a reportable disease as such, mass statistics cannot be determined. The most accurate statistics should come from military hospitals where all cases of mumps are observed closely. Such a report was made by Larkin (*7*) who, in 1918, found 2 patients with meningeal symptoms in 2,400 cases of mumps at an Army training camp, an incidence of less than 0.1 percent. Further, the wide variance of reported incidence indicates that the frequency of neurologic complications varies markedly in different epidemic periods and in different localities. Thus the incidence of 6 percent noted here,

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while epidemiologically accurate, is an index only of the meningo-encephalitis complicating the mumps cases seen in this area at this particular epidemic period.

The specific cause of mumps meningo-encephalitis would seem to be either the mumps virus itself or a toxin liberated by the virus. The most decisive work was done by Wollstein (*8*). In her experiments she used pooled, filtered mouth washings from mumps patients. The filtrate was injected into cats subcutaneously, into the parotids, and intrathecally; the latter procedure inducing symptoms of meningitis. With the spinal fluid from cats so affected, she was able to produce the disease in other cats. Control tests with filtered saliva from normal human subjects gave negative results. Gordon (*9*) in 1913 produced encephalitis in monkeys by intraspinal injections of mumps saliva filtrates. From the case of mumps myelitis reported by McKaig and Woltman (*10*), cultures taken from Steno's duct were injected into rabbits with resultant paralysis in 8 hours in one instance. All these experiments suggest that the virus itself is the causative agent of the meningitis; further, the occurrence of neurologic symptoms before the glandular localization in some cases would tend to negate the virus toxin theory. Whether the virus spreads from the parotid to the meninges directly through the nasopharynx or through the blood stream is as yet undetermined, although the blood stream route of invasion seems most probable.

Since mumps meningo-encephalitis is rarely fatal, pathologic reports are few. From the papers by Larkin and Gordon it appears that there is a congestion of the pia with patchy infiltration of the parenchyma along the cerebral blood vessels.

The symptomatology of mumps meningitis is not characteristically distinctive, yet our cases showed a fair degree of similarity. Table 1 summarizes the clinical picture of cases seen here. The onset of the mumps meningo-encephalitis may occur at quite varying intervals after the onset of the parotitis. The majority of cases occur in from 2 to 10 days after the appearance of parotid swelling. Occasionally the meningo-encephalitis develops simultaneously with the mumps, as was noted in one of our patients. Rarely the neurologic symptoms may precede the parotitis as reported by Casparis (*11*) and Walker (*12*). One of our patients had a meningo-encephalitis for 4 days before his parotitis appeared and etiologic diagnosis could be established. Finally there are some cases in which the meningo-encephalitis would appear to be of undoubted mumps origin by virtue of epidemiologic contact, but in which a parotitis never occurs or is so slight as to escape notice.

The onset of the meningo-encephalitis is rather sudden; the initial symptom is almost invariably a severe, persistent headache, which was

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noted in all our patients. Vomiting occurred in 6 of the 10 patients but was not incessant and rarely persisted for over 24 hours. All patients had varying degrees of fever, ranging from 101° to 105° F. Hiccough, lethargy, or irritability were present in a few of the patients but were never very pronounced symptoms. No convulsions or evidence of focal lesions were noted in these patients, although such symptoms have been reported.

TABLE 1.—*Summary of symptoms and findings*

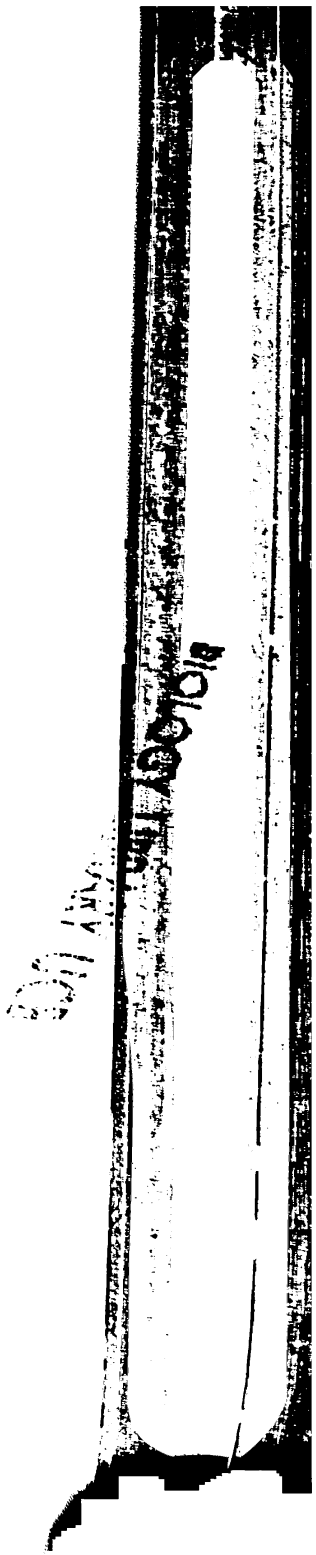
Total number of cases	10 (6% of mumps admissions).
Symptoms:	
Headache	Present in all patients (100%).
Vomiting	Present in 6 patients (60%).
Fever	Present in all patients (100%).
Neurologic findings:	
Neck rigidity	Present in all patients (100%).
Positive Kernig	Present in 5 patients (50%).
Tache cerebrale	Present in 4 patients (40%).
Spinal fluid:	
Pressure	Normal to slightly increased.
Cell count	Varied from 73 to 602 (90%–100% lymphocytes).
Total protein	Increased in 3 fluids tested (55–74 mg./100 cc.).
Cultures	All negative.

The neurologic examination almost always reveals neck rigidity, usually mild in nature. A positive Kernig was observed in half the patients. The reflexes were occasionally hyperactive, and a positive tache was noted in four of the patients. No focal neurologic signs were observed.

Lumbar puncture was performed in all cases. In general the spinal fluid was clear and under normal or slightly increased pressure. The fluid is much like that of any of the other encephalitides and the cell count may vary from 20 to 2,000 or more. In the cases seen here the spinal fluid cell count varied from 73 to 602, averaging 304 per cubic millimeter. The cells are predominately lymphocytes. Spinal fluid total protein was determined in 3 patients and found slightly elevated. Spinal fluid cultures were entirely negative.

The meningo-encephalitic symptoms usually persist for 3 to 6 days. In general the temperature returns to normal and the subjective symptoms subside before the neurologic findings are normal. Recovery has been rapidly complete in all our cases and no sequelae have occurred. In some reported cases however, hemiplegia, aphasia, focal paralysis, and optic neuritis have been described.

The differential diagnosis of mumps meningo-encephalitis is usually not troublesome. Essentially an awareness of the occurrence of this complication in epidemic parotitis readily leads to a correct diagnostic interpretation. The presence of mild neurologic, predominately meningeal, symptoms in conjunction with a high spinal fluid cell count is a valuable diagnostic criterion.



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The treatment of this condition is entirely symptomatic. Spinal puncture should be performed as a diagnostic procedure; it is also often of value in reducing spinal fluid pressure, particularly in those cases with persistent headache and vomiting. Such symptomatic relief after lumbar puncture was observed in four of the patients seen here, but this response may have been partly or largely psychotherapeutic.

This report represents the observations in a relatively small series of patients, but the rather high incidence of complicating meningo-encephalitis is of more than didactic interest. It is felt that increasing awareness of this complication will result in its more frequent recognition.

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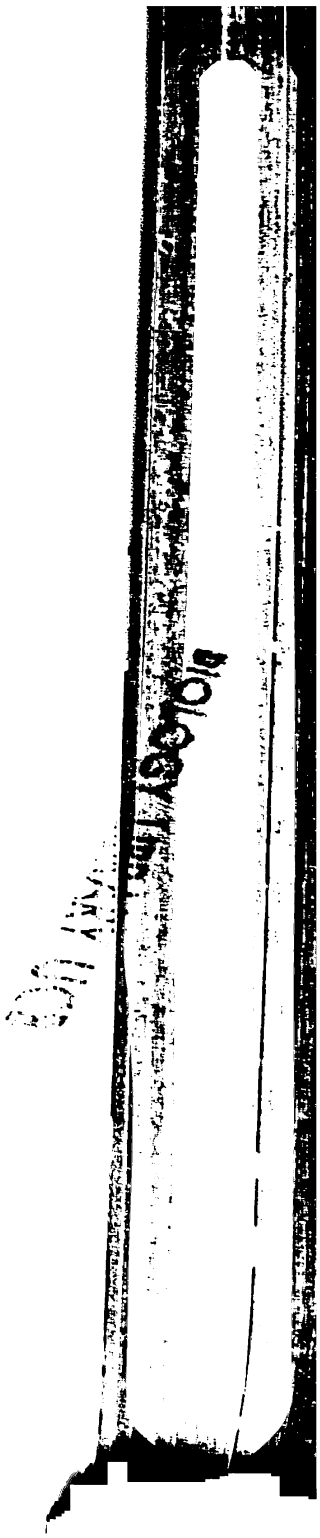
PENATIN

A second bactericidal substance is reported to have been isolated from the same source as penicillin (Penicillium notatum), to which the name "penatin" has been given. While penicillin is a nitrogen-containing substance of low molecular weight, soluble in organic solvents, the new penatin is a complex protein, not dialyzable or extractable by organic solvents. The action of penatin is attributed to its ability to decompose dextrose with the liberation of hydrogen peroxide, which is toxic to bacteria. Penatin is highly bacteriostatic and bactericidal in the presence of dextrose, and is particularly effective against gram-negative organisms not readily acted upon by penicillin. Fairly large doses of penatin have been injected successfully into experimental animals, and small amounts are even tolerated intravenously.—Editorial comment. What's been going on. J. Chem. Ed. 20: 608, December 1943.

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ERYTHROCYTE SEDIMENTATION RATE IN MUMPS AND ITS COMPLICATIONS

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The occurrence of an epidemic of mumps at this activity presented the opportunity of observing two interesting phenomena associated with this disease: The first, which characterized this particular epidemic was the pleocytosis in the spinal fluid of practically all of the patients and the high incidence of frank meningitis as a complication. The second, which constitutes the theme of this paper, was observations made on the erythrocyte sedimentation rate in mumps, mumps meningitis and mumps orchitis.

Thirty-seven consecutive cases of mumps were studied. All were male patients. Of this number, 13 were entirely uncomplicated; 10 were complicated with meningitis; and 14 were complicated with orchitis. No case of mumps pancreatitis was encountered.

The Cutler[1] method was used to determine the erythrocyte sedimentation rate. Four and one half cubic centimeters of blood were drawn from a vein and mixed with one-half cubic centimeter of 3-percent sodium citrate solution in a 5-cc. tube graduated in millimeters. Readings were taken at the end of 15 minutes and at the end of 1 hour.

As a control group, 30 consecutive healthy males were studied. Blood was drawn from a vein and the sedimentation rate was determined. The results are tabulated in table 1. From these the true mean, standard deviation and their probable errors are calculated.

Table 2 analyzes the 13 cases of uncomplicated mumps. In this table and in those that follow, the sedimentation rate utilized was the most rapid obtained in the course of the disease. Each patient had from 2 to 5 determinations done.

[1] Cutler, J.: Graphic presentation of blood sedimentation test; study in pulmonary tuberculosis. Am. J. M. Sc. 171: 882–901, June 1926.

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TABLE I.—*Control group. Calculation of mean and standard deviation with their probable errors*

E. S. R. millimeters in 1 hour*		f	d'	$f(d')$	$f(d')^2$
Arbitrary mean	0.0 . . . 1.9	0	−3	0	0
	2.0 . . . 3.9	3	−2	−6	12
	4.0 . . . 5.9	8	−1	−8	8
	6.0 . . . 7.9	10	0	0	0
	8.0 . . . 9.9	7	+1	+7	7
	10.0 . . . 11.9	1	+2	+2	4
	12.0 . . . 13.9	1	+3	+3	9
	Total	30		−2	40

*Erythrocyte sedimentation rate arranged in class intervals of 2 millimeters = C.
f = Absolute frequency of occurrence.
d' = Deviation from arbitrary mean.

Arbitrary mean $= 7.0$

True mean $= \text{Arbitrary mean} + \frac{\Sigma f(d')}{\Sigma f} \times C$

$= 7.0 + \left(\frac{-2}{30} \times 2\right)$

$= 6.89$

Standard deviation $= C\sqrt{\frac{\Sigma f(d')^2}{\Sigma f} - \left(\frac{\Sigma f(d')}{\Sigma f}\right)^2}$

$= 2\sqrt{\frac{40}{30} - \left(\frac{-2}{30}\right)^2}$

$= 2.3$

Probable error of mean $= 0.6745 \times \frac{d}{\sqrt{N}}$ (d = Standard deviation. N = Number of cases.)

$= 0.6745 \times \frac{2.30}{\sqrt{30}}$

$= 0.28$

Probable error, standard deviation $= 0.6745 \times \frac{d}{\sqrt{2N}}$

$= 0.6745 \times \frac{2.30}{\sqrt{60}}$

$= 0.20$

Summarizing: Mean $= 6.89 \pm 0.28$

Standard deviation $= 2.3 \pm 0.20$

TABLE 2.—*Uncomplicated mumps. Calculation of mean and standard deviation with their probable erorrs*

E. S. R. millimeters in 1 hour*		f	d'	$f(d')$	$f(d')^2$
Arbitrary Mean	0.0 . . . 1.9	0	−4	0	0
	2.0 . . . 3.9	1	−3	−3	9
	4.0 . . . 5.9	1	−2	−2	4
	6.0 . . . 7.9	2	−1	−2	2
	8.0 . . . 9.9	4	0	0	0
	10.0 . . . 11.9	0	+1	0	0
	12.0 . . . 13.9	2	+2	+4	8
	14.0 . . . 15.9	2	+3	+6	18
	16.0 . . . 17.9	0	+4	0	0
	18.0 . . . 19.9	1	+5	+5	25
	Total	13		+8	66

*Erythrocyte sedimentation rate arranged in class intervals of 2 millimeters = C.
f = Absolute frequency of occurrence.
d' = Deviation from arbitrary mean.

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Arbitrary mean $=9.0$

True mean $=\text{Arbitrary mean}+\frac{\Sigma f(d')}{\Sigma f}\times C$

$=9+\frac{8}{13}\times 2$

$=10.23$

Standard deviation $=C\sqrt{\frac{\Sigma f(d')^2}{\Sigma f}-\left(\frac{\Sigma f(d')}{\Sigma f}\right)^2}$

$=2\sqrt{\frac{66}{13}-\left(\frac{8}{13}\right)^2}$

$=4.23$

Probable error of mean $=0.6745\times\frac{d}{\sqrt{N}}$ d = Standard deviation. N = Number of cases.

$=0.6745\times\frac{4.23}{\sqrt{13}}$

$=0.79$

Probable error, standard deviation $=0.6745\times\frac{d}{\sqrt{2N}}$

$=0.6745\times\frac{4.23}{\sqrt{26}}$

$=0.55$

Summarizing: Mean $=10.23\pm0.79$

Standard deviation $=4.23\pm0.55$

Table 3 analyzes 10 cases of mumps meningitis.

TABLE 3.—*Calculation of mean and standard deviation with their probable errors*

E. S. R. millimeters in 1 hour*		d	d'	$f(d')$	$f(d')^2$
Arbitrary mean	0.0 . . . 1.9	0	−5	0	0
	2.0 . . . 3.9	1	−4	−4	16
	4.0 . . . 5.9	0	−3	0	0
	6.0 . . . 7.9	1	−2	−2	4
	8.0 . . . 9.9	4	−1	−4	4
	10.0 . . . 11.9	1	0	0	0
	12.0 . . . 13.9	2	+1	+2	2
	14.0 . . . 15.9	0	+2	0	0
	16.0 . . . 17.9	1	+3	+3	9
	Total	10		−5	35

* Erythrocyte sedimentation rate arranged in class intervals of 2 millimeters = C.
f = Absolute frequency of occurrence.
d' = Deviation from arbitrary mean.

Arbitrary mean $=11.0$

True mean $=\text{Arbitrary mean}+\frac{\Sigma f(d')}{\Sigma f}\times C$

$=11+\frac{-5}{10}\times 2$

$=10.00$

Standard deviation $=C\sqrt{\frac{\Sigma f(d')^2}{\Sigma f}-\left(\frac{\Sigma f(d')}{\Sigma f}\right)^2}$

$=2\sqrt{\frac{35}{10}-\left(\frac{-5}{10}\right)^2}$

$=3.6$

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Probable error of mean $= 0.6745 \times \frac{d}{\sqrt{N}}$ d = Standard deviation. N = Number of cases.

$= 0.6745 \times \frac{3.6}{\sqrt{10}}$

$= 0.77$

Probable error of standard deviation $= 0.6745 \times \frac{d}{\sqrt{2N}}$

$= 0.6745 \times \frac{3.6}{\sqrt{20}}$

$= 0.54$

Summarizing: Mean $= 10.0 \pm 0.77$

Standard deviation $= 3.6 \pm 0.54$

Table 4 analyzes 14 cases of mumps orchitis.

TABLE 4.—*Calculation of mean and standard deviation with their probable errors*

E. S. R. millimeters in 1 hour *		f	d'	$f(d')$	$f(d')^2$
Arbitrary mean	12.0 . . . 13.9	0	−4	0	0
	14.0 . . . 15.9	1	−3	−3	9
	16.0 . . . 17.9	0	−2	0	0
	18.0 . . . 19.9	4	−1	−4	4
	20.0 . . . 21.9	1	0	0	0
	22.0 . . . 23.9	5	+1	+5	5
	24.0 . . . 25.9	1	+2	+2	4
	26.0 . . . 27.9	2	+3	+6	18
	Total	14	.....	+6	40

*Erythrocyte sedimentation rate arranged in class intervals of 2 millimeters = C.
f = Absolute frequency of occurrence.
d' = Deviation from arbitrary mean.

Arbitrary mean $= 21.0$

True mean $= \text{Arbitrary mean} + \frac{\Sigma f(d')}{\Sigma f} \times C$

$= 21.0 + \frac{6}{14} \times 2$

$= 21.85$

Standard deviation $= C\sqrt{\frac{\Sigma f(d')^2}{\Sigma f} - \left(\frac{\Sigma f(d')}{\Sigma f}\right)^2}$

$= 2\sqrt{\frac{40}{14} - \left(\frac{6}{14}\right)^2}$

$= 3.52$

Probable error of mean $= 0.6745 \times \frac{d}{\sqrt{N}}$ d = Standard deviation. N = Number of cases.

$= 0.6745 \times \frac{3.52}{\sqrt{14}}$

$= 0.63$

Probable error of standard deviation $= 0.6745 \times \frac{d}{\sqrt{2N}}$

$= 0.6745 \times \frac{3.52}{\sqrt{28}}$

$= 0.44$

Summarizing: Mean $= 21.85 \pm 0.63$

Standard deviation $= 3.52 \pm 0.44$

Table 5 is a summary of all the findings in the control and in the experimental groups.

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TABLE 5.—*Summary*

Group	Mean	Standard deviation
Control	6.89±0.28	2.3 ±0.20
Mumps—uncomplicated	10.23±0.79	4.23±0.55
Mumps—meningitis	10.0 ±0.77	3.6 ±0.54
Mumps—orchitis	21.85±0.63	3.52±0.44

It can be seen in table 5 that the mean sedimentation rate in uncomplicated mumps and mumps meningitis as well as in mumps orchitis apparently differs from the mean sedimentation rate of the control group. It is necessary, therefore, to probe the significance of these differences. The calculations below present an analysis to determine the significance of the differences between these means.

To determine the significance of the difference between the mean erythrocyte sedimentation rate of the control group and the mean erythrocyte sedimentation rate of the group with uncomplicated mumps:

$$D=\sqrt{\frac{(d_1)^2}{N_1}+\frac{(d_2)^2}{N}}$$

D = Standard error of the difference between 2 means.
d_1 = Standard deviation of group 1.
d_2 = Standard deviation of group 2.
N_1 = Number of cases in group 1.
N_2 = Number of cases in group 2.

$$D=\sqrt{\frac{(2.3)^2}{30}+\frac{(4.23)^2}{13}}$$
$$=1.24$$

The mean mumps uncomplicated	10.23
The mean control group	6.89
The difference	3.34

A difference of as large as 3.72 (3 standard errors of the difference between 2 means) might (99.7 chances in 100) arise due to chance. Since the actual difference of the 2 means in question is less than this amount (3.34), it is extremely likely that the difference is due to chance. Therefore there is no significant difference between the two means.

In like manner the mean of the control group is compared with the mumps meningitis group.

$$D=\sqrt{\frac{(2.3)^2}{30}+\frac{(3.6)^2}{10}}$$
$$=1.21$$

The mean mumps meningitis	10.0
The mean control group	6.89
The difference	3.11

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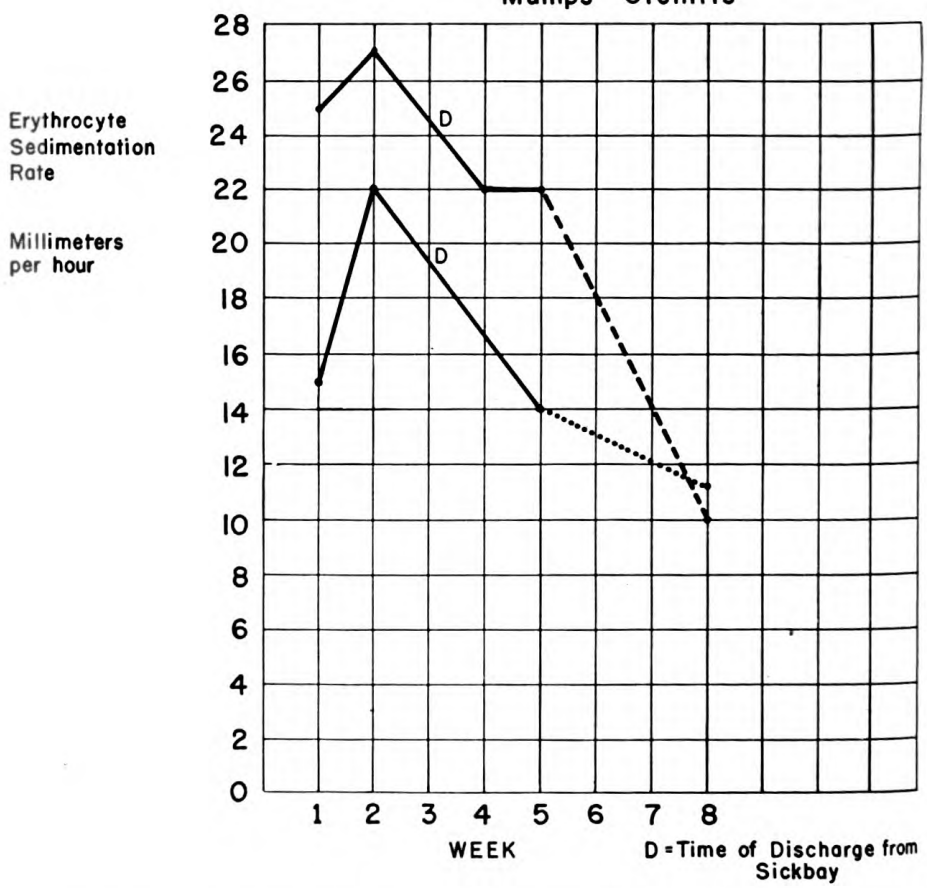
A difference of 3.63 might arise due to chance. Since the actual difference of the two means in question is less than this amount (3.11), it is extremely likely that the difference is due to chance. Therefore there is no significant difference between these two means.

In like manner the mean of the control group is compared with the mumps orchitis group.

$$D=\sqrt{\frac{(2.3)^2}{30}+\frac{(3.52)^2}{14}}$$
$$=1.03$$

The mean mumps orchitis	21.85
The mean control group	6.89
The difference	14.96

GRAPH 1



A difference of as large as 3.09 might arise due to chance. Since the actual difference of the two means in question is greatly larger than this amount, it is extremely unlikely that it arose due to chance. And, therefore, the mean erythrocyte sedimentation rate in the mumps orchitis group differs significantly from the control group and is greatly increased.

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We may therefore conclude that in uncomplicated mumps and in mumps meningitis the erythrocyte sedimentation rate does not differ significantly from the normal, while in mumps orchitis there is a marked increase in the rapidity of the erythrocyte sedimentation rate. On admission, in several patients with mumps, the presence of a rapid sedimentation rate above 15 millimeters per hour enabled us to predict the appearance of orchitis as a complication of the disease.

In the graph presented on page 576 appear the weekly sedimentation rates of two patients with orchitis as a complication. It is apparent that the sedimentation rate in these patients remained elevated for weeks after discharge from the sickbay and possibly signifies the persistence of an active inflammatory or degenerative process in the testis.

CONCLUSIONS

1. The erythrocyte sedimentation rate is markedly increased in mumps orchitis.
2. An increased erythrocyte sedimentation rate may precede the appearance of orchitis as a complication.
3. In mumps orchitis, a rapid sedimentation rate may persist for weeks after apparent recovery and possibly denotes the persistence of an inflammatory or degenerative process in the testis.
4. The erythrocyte sedimentation rate shows no significant deviation from the normal in uncomplicated mumps.
5. The erythrocyte sedimentation rate shows no significant deviation from the normal in mumps meningitis.

SULFADIAZINE TREATMENT OF AGRANULOCYTOSIS

Three cases of severe agranulocytosis due to sulfadiazine were treated successfully with large doses of sulfadiazine. The agranulocytosis occurred during the course of acute infections (scarlet fever in 1 case and primary atypical virus pneumonia in 2 cases). Each patient had received moderate doses of sulfadiazine for 2 or more weeks prior to the onset of bone marrow depression. Transfusions, pentose nucleotides and liver extract in case 1 were without any demonstrable beneficial effect. Convalescent human serum was used as an adjunct to the sulfadiazine therapy in each of the three patients while oxygen was administered in cases 2 and 3. Even though the infectious processes may have played a part, sulfadiazine probably was the primary factor in causing the agranulocytosis. However, the subsequent administration of large amounts of the same drug seemed responsible for the ultimate recoveries.—Nixon, N.; Eckert, J. F.; and Holmes, K. B.: The treatment of agranulocytosis with sulfadiazine. Am. J. M. Sc. **206**: 713–722, December 1943.

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A METHOD AND STUDY OF SURFACE DECOMPRESSION AS A ROUTINE PROCEDURE

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Surface decompression may be defined as the procedure of bringing a diver from the bottom directly to the surface with limited decompression in the water, followed immediately by recompression in a chamber, and subsequent full decompression.

This procedure was first employed by Saunders in the salvage of the *S–51* in 1925, because cold water and tides rendered decompression in the open sea impracticable. In 1939 it was extensively employed in the salvage operations required to raise the U. S. S. *Squalus*.[1]

Surface decompression permits the elimination of excess gas from the body tissues under ideal conditions, that is with the diver warm, at rest, and under observation. The danger of surface decompression lies in the formation of extensive gas embolism during the interval between the removal of the diver from the water and his subsequent recompression on the surface.

The question, then, of what constitutes a safe time-interval between the last stop in the water and recompression in the chamber, becomes of paramount importance. This study was undertaken to tabulate facts on surface decompression, paying special attention to the time elapsing from the beginning of ascent to the surface and recompression in the chamber, and to the use of oxygen. In addition, it was desirable to find a safe and practical method whereby this procedure could become routine. Thus the underwater work could be expedited by allowing longer dives in cold water, and clearing the diving stage earlier so that another diver could go down without delay.

One hundred thirty dives were made in which surface decompression was used. The depths of the dives ranged from 66 feet to 108 feet, and the time spent on the bottom from 26 minutes to 166 minutes. The interval following ascent to the surface and recompression ranged from 3.5 to 14 minutes, the average being 6.3 minutes. The data are summarized in table 1.

The absence of a recompression chamber on the diving boat necessitated the transportation of the divers to the chamber on a barge. The

[1] Behnke, A. R., and Willmon, T. L.: U. S. S. *Squalus;* medical aspects of rescue and salvage operations and use of oxygen in deep-sea diving. U. S. Nav. M. Bull. **37**: 629–640, October 1939.

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average distance was 175 to 200 yards. This factor alone tended to overstep the 3- to 4-minute interval to be without compression, stated in the Diving Manual as the maximal desirable period.

TABLE 1.—*Diving data*

Depth in feet	Number of dives	Duration of time on bottom in minutes		Duration of time on stage in minutes		Time to surface and first recompression stop in minutes		Recompression time in minutes
		Average	Range	Average	Range	Average	Range	Average
66–84	72	79	26–132	5.3	5–10	6.1	3.5–14	31.8
85–95	34	79	45–166	6.3	5–10	6.8	4–11	55.9
96–108	24	84	36–120	6.0	5–10	6.3	3–11	70.8

NOTE.—Since this was compiled an additional 170 dives have been studied with comparable results.

The divers observed in this study were engaged in salvaging torpedoes. No selection of divers for surface decompression was made. All men, regardless of time on the bottom, or the depth of the water, were routinely given surface decompression. In a representative decompression the diver was brought up to his first stop in the water at a rate of approximately 35 to 40 feet per minute. He was given 5 minutes on the stage at the first stop, and then taken directly to the surface, undressed, taken into the chamber, and recompressed to the first decompression stop. The elapsed time was taken as the interval between the appearance of the diver's helmet on the surface and his recompression to the first stop. The decompression given in the chamber was the same as that which would have been given in the water, in accordance with the Diving Manual tables. One to two minutes of moderate exercise at each stop was prescribed in order to increase circulation.[1] In about two-thirds of the long decompressions an oxygen mask was used 15 to 30 minutes, the length of the decompression governing the time on oxygen.

The results indicate that the surface interval before recompression is applied, may be prolonged under certain conditions to 14 minutes without the occurrence of bends. However, the objective is to reduce this interval to a minimal period not to exceed 3 or 4 minutes as stated in the Diving Manual.

RESULTS AND CONCLUSIONS

1. One hundred thirty divers were given surface decompression with time on the bottom ranging from 26 to 166 minutes, and from depths of 66 to 108 feet. The time interval to the first stop in the chamber ranged from 3.5 to 14 minutes, the average being 6.3 minutes. In this series no cases of bends occurred and the divers suffered no apparent ill effects.

[1] Recent work in aviation decompression indicates that exercise greatly increases the tendency for compressed air illness to develop.

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2. Oxygen is not essential, as some of the decompressions were given without it. However, its use eliminates the after-fatigue. This after-fatigue is probably due to minute bubble formation which means that the margin of safety has been reached. Oxygen is therefore an additional safety factor in surface decompression.

3. In dives similar to those described, it would not be necessary to give oxygen on the diving stage, but it would be feasible to take the diver directly out of the water into the chamber and finish the decompression according to an oxygen table. This procedure would not require a change of equipment and would save oxygen, as more gas would be needed when supplied to a diver's suit than to a mask worn by a diver in the chamber.

4. The surface decompression used as described with or without oxygen has proved an effective method for decompression of divers in cold water and other emergency situations. However, the greatest advantages are the safety of the method and the increase of the working capacity of a diving crew. One man can be decompressed in the chamber, and another diver can go down immediately, thus eliminating delay in waiting for the full completion of surface decompression. It is used here as a routine procedure.



THE HEART IN DENGUE

The disease was characterized by slow pulse rate, low blood pressure, leukopenia, high temperature and slow recovery from extreme physical and mental depression. The slow pulse rate was investigated by various methods and was found to be due to a simple sinus bradycardia, probably the result of autonomic involvement by the virus infection.

A number of disturbances of conduction were discovered by electrocardiographic examination; these consisted in delay of the PR interval and widening of the QRS complex.

Irregularities of rhythm were chiefly due to extrasystoles; these were mostly ventricular in origin.

The blood pressure was consistently low in almost every case, and the levels remained low for some time after the attack of dengue.

Previous observations on patients with postinfluenzal heart disease suggest that the cardiovascular symptoms occurring in dengue may be due to excessive vagal or autonomic response to virus infection. Belladonna or atropine may have a place in the treatment of the cardiac symptoms and the post-dengue physical depression, which is responsible for many extra sick days and the loss of vital manpower.—Hyman, A. S.: The heart in dengue; some observations made among Navy and Marine combat units in the south Pacific. War Med. **4**: 497–501, November 1943.

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ESTABLISHMENT OF A DENTAL SECTION

IN THE MEDICAL BATTALION OF MARINE DIVISIONS OF THE FLEET MARINE FORCE

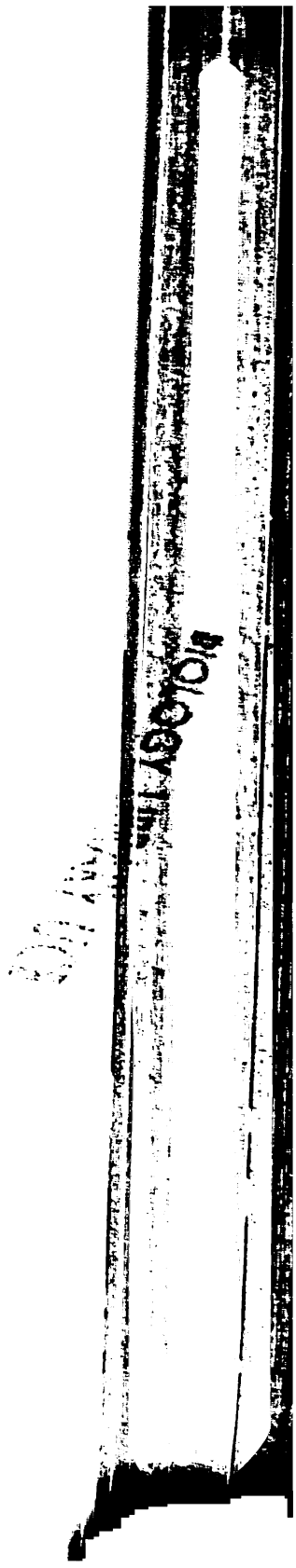
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Captain (DC) U. S. N.

As a result of the Guadalcanal operation of the First Marine Division of the Fleet Marine Force it became apparent that not only were the numbers of dental officers and dental technicians attached to divisions of the Fleet Marine Force inadequate, but also that due to their inability to set up offices in the various regimental headquarters in consequence of the restricted area and constant enemy activity, the services of those so attached had not been utilized to the greatest advantage during this operation.

Commander E. DeW. Foulk (DC), U. S. N. on 12 March 1943 in his report to the Bureau of Medicine and Surgery on dental activities during this operation, stated that throughout a great part of the campaign, particularly the opening phases, it had been "inadvisable if not impossible" for regimental dental officers to function as such, but that they did perform invaluable work as assistant medical officers. He further stated that:

> Regimental dental officers in this particular action were not necessarily essential in the field, since with the constricted area of operations, casualties were evacuated directly to field hospitals and little or no dental repair or surgery was done in the regimental areas. Thus dental officers were attached to units where they could not function in their professional capacity and there was a shortage in areas where it was possible to set up offices. It is felt that the addition of one, or perhaps two, more dental officers to the medical companies would correct this and aid immeasurably in taking care of the overwhelming amount of accumulated dental work that has to be taken care of in the short periods of noncombatant status. This would work out nicely, since the medical companies operate in the areas of the regiments to which they are assigned. It is felt that any addition of dental officers to the regiments is definitely neither desirable nor practical since their professional services in the field would be completely lost.

These views were in agreement with those of the division surgeon of the First Marine Division, and with the opinions of other interested dental officers. On 16 October the Surgeon General recommended to the Commandant of the Marine Corps that the officer complement of the various units of the Fleet Marine Force be revised to include a minimum of one dental officer per thousand personnel. This recom-



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mended change was approved by the Commandant and forwarded to the Bureau of Personnel.

Following this exchange of correspondence a conference was held between representatives of the Commandant of the Marine Corps and the Surgeon General for the purpose of determining whether the entire dental organization within the Marine Division should be revamped, or whether the then current organization should remain intact but be augmented by additional dental facilities. In case it was decided to follow the latter course, decision had to be made as to the part of the division organization best adapted for the assimilation of this additional personnel, material, and function. Consideration was also given to the effect that the change would have on Basic Allowance Lists as well as Marine Corps Tables of Organization.

Reports from the theater of operations had called attention to the limitations that were placed upon the professional activities of the regimental dental officer in a specific amphibious operation but had also cited his value as an "assistant medical officer." The point at issue was whether the value of the regimental dental officer, functioning during combat as a medical officer, was sufficient to warrant the loss of a considerable portion of this highly trained personnel during action. Undoubtedly there was and would continue to be a great need for the services of the regimental dental officer as such; hence it was decided that while no additional dental personnel would be added to the regiment, the assignment of dental officers to the headquarters and service companies of regiments would be continued.

Diametrically opposed to the assignment of additional dental personnel to the regimental organization was the proposal that this additional personnel be carried as a pool of officers who would be attached to the division but whose services would be utilized by temporary assignment to the nearest base hospital, or elsewhere, within the sphere of activities of the rear echelon. This plan was considered entirely unsatisfactory due to (1) the lack of assurance that there would be adequate facilities available for the use of dental officers attached to base hospitals in an additional duty status, (2) the lack of flexibility resulting from duplication of orders and overlapping authority, (3) the very considerable distances which will frequently be found between the first and last echelons of a movement, and (4) the adverse effect on esprit de corps that such an arrangement might have, since the personnel of the pool would be deprived of any opportunity to serve in an active capacity.

The third plan to be considered was that this personnel should be divided between and attached to the several medical companies of the medical battalion as had been suggested from the field. It was decided that while this plan had a considerable amount of virtue, if effectuated it would result in some lack of elasticity due to the division of the

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dental personnel into small groups serving under separate company commanders.

It was the opinion of the conferees that the fourth plan considered included the principal virtues of those plans previously rejected and excluded their shortcomings. This plan was accordingly adopted. It permits the status quo of the dental organization within the division to remain intact, but supplements it by 21 additional dental officers and an equal number of dental technicians. The dental personnel attached to a marine division is thereby increased to a total of 33 officers and 33 men.

Of the 21 dental officers added to the division the senior is attached to the Battalion Headquarters, Headquarters and Service Company, of the Medical Battalion as assistant to the division surgeon. The 20 remaining officers are assigned to the Headquarters and Service Company of the Medical Battalion, where, with technicians and equipment, they will function as the Dental Section of that company.

This change in organization of the dental service within the division achieves a dual objective in that no component of the division is deprived of that dental service which has been and still is considered essential to it, and in that an improved dental service is assured.

It is anticipated that not only will the actual amount of dental service being rendered to the troops in the field be increased, but the scope of this service will be broadened by the addition of field prosthetic dental facilities to function as an integral part of the Dental Section.

The assignment of the senior dental officer within the division to duty as assistant to the division surgeon will result in closer supervision of the dental officers attached to the division, as well as an improvement in the supervision, distribution, and upkeep of dental supplies and equipment.

The establishment of the Dental Section has the marked advantage of creating a highly mobile field dental facility, the services of which can be used in whole or in part at any point within the area of activity of the division where the need for this service is most urgent.

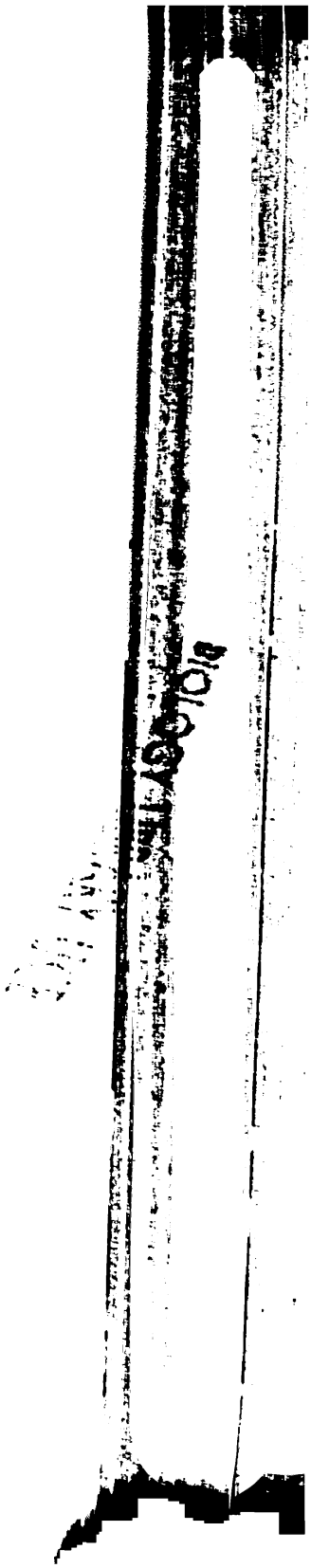
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WATER-PITRESSIN TEST IN EPILEPSY

For the purpose of diagnosis, fits can often be induced in epileptics by giving large quantities of fluid by mouth, together with injections of pituitary extract containing vasopressin (Pitressin).

This procedure has never yet induced a fit in a person who was not an epileptic.

Such a test is valuable in the Services, where rapid recognition and disposal of epileptics is required.—Garland, H. G.; Dick, A. P.; and Whitty, C. W. M.: Water-pitressin test in the diagnosis of epilepsy. Lancet 2: 566–569, November 6, 1943.



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EVALUATION OF BISMUTH AND ARSENICALS IN THE TREATMENT OF VINCENT'S GINGIVITIS

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Intravenous administration of arsenical compounds has long been advocated in the treatment of Vincent's gingivitis, particularly in patients in whom the infection has not responded readily to local measures. This report is made in the hope that it will shed some light upon the arsenical-resistant type of Vincent's gingivitis.

War conditions impose an unavoidable amount of crowding aboard combat ships. Owing to these exigencies personnel must of necessity be augmented over the peacetime complement. This crowding tends to make endemic certain more or less benign diseases, among which Vincent's gingivitis is very important. Since this infection is highly contagious, a careful study of the known cases has constantly been in progress aboard this ship. Despite all feasible measures of prevention, however, a moderate number of cases continued to develop.

The appearance of Vincent's gingivitis in a patient who was simultaneously being treated for syphilis by weekly intravenous injections of mapharsen led to further investigation of arsenical compounds in the treatment of Vincent's infection.

All syphilitic patients under treatment with arsenical compounds were examined for the presence of Vincent's gingivitis. Each patient was given a thorough oral examination. The flaps over erupting third molars were carefully probed, and the interdental papillae were inspected for edema and palpated for tenderness. If any small, flat, punched-out ulcers were noted, smears for microscopic study were made from these areas. The odor of the patient's breath was noted in order to compare it with the characteristic odor found in cases of Vincent's gingivitis. Color and general tone of the gingival tissue were also recorded.

The presence of Vincent's organisms in a smear taken for microscopic study is not proof that the patient is afflicted with the disease. This cannot be overemphasized, for it is highly probable that these organisms are present in all adult mouths, and cannot be dispossessed for any considerable length of time. In fact Stafne states that spirochaetaceae and Fusiformis dentium were both present in about 75 percent of adult mouths examined, in spite of the absence of objec-

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tive or subjective symptoms of Vincent's gingivitis. The smear alone, therefore, cannot be considered diagnostic.

Several confirmed cases of Vincent's gingivitis of various degrees were found among patients who were being treated for syphilis. These patients as a rule received 10 intravenous doses of an arsenical compound, followed by 10 doses of bismuth intramuscularly, after which the series was repeated. The 2 types of medication were given simultaneously on the occasions of the last 2 injections in each series, so that actually the patient received 10 injections of an arsenical compound every 16 weeks. The standards dosage were employed except in a few patients who regularly receivd 2 doses weekly instead of 1.

Repeated oral studies were carried out on 19 of these patients selected more or less at random. Smears from the exudate of all the suspected areas were made daily for 3 to 5 days, and no case was included which did not consistently show Vincent's organisms. Two of the 19 patients were found to have an acute and 5 a chronic Vincent's gingivitis. In 4 a few Vincent's organisms were present but clinical evidence did not substantiate this diagnosis.

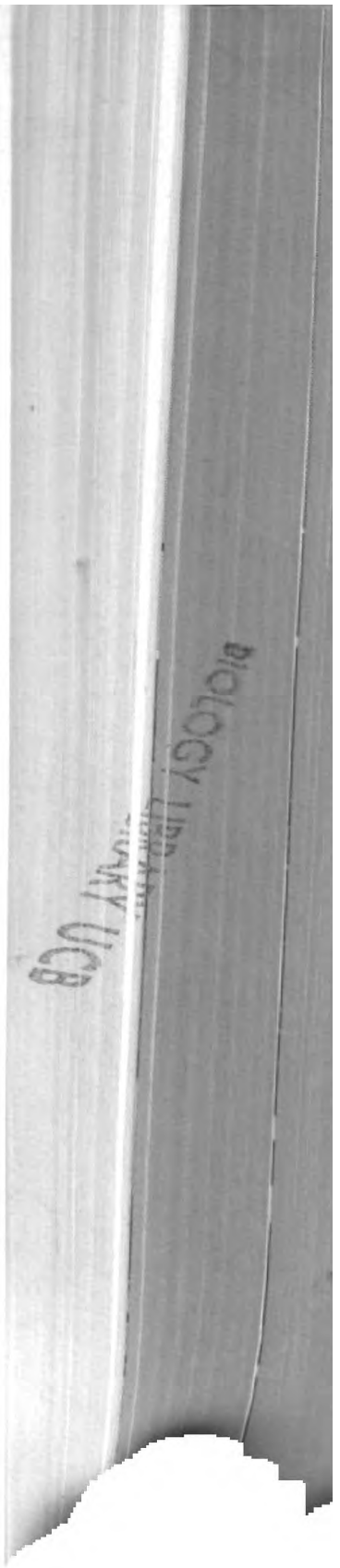
The most significant observations were made on 3 patients who had received the so-called 5-day antiluetic treatment in which the arsenical equivalent of 32 weeks' treatment is administered over a 5-day period. These dosages were many times greater than the amount ordinarily given in the treatment of Vincent's gingivitis. In spite of these extremely large doses of arsenical compound, Vincent's organisms were found daily in the smears made from 2 of the 3 patients. These 2 patients did not show any clinical symptoms of Vincent's gingivitis. It was also noted that none of the 3 patients exhibited any symptoms of an arsenical gingivitis.

The frequent incidental finding of bismuth gingivitis should be mentioned. Bismuth may produce a gingivitis if a large quantity of this drug gets into the circulatory system. Certain definite oral manifestations will appear, such as discoloration of the interproximal tissue, edema of the gingival tissue, marked tendency to hemorrhage, collection of serumal and salivary calculi, and fetid breath. All of these symptoms and physical findings were found repeatedly in the patients receiving bismuth in the treatment of syphilis. It is felt that this bismuth gingivitis might be significant as a contributory factor in the production of Vincent's gingivitis, but this is mere conjecture.

The confirmed cases are briefly outlined in the following reports:

CASE REPORTS

Case 1.—A seaman, first class, age 23 years, had received the regular treatment for syphilis for 5 months prior to complaining of a sore mouth. He had completed his first bismuth series and had had seven arsenical injections. Oral



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hygiene was badly neglected. Serviceable occlusion was present though several bicuspids and molars were absent. Repeated smears and oral examination confirmed the diagnosis of Vincent's gingivitis, acute.

Case 2.—A boatswain's mate, first class, age 35 years, had been receiving syphilitic treatment for 15 months. He had completed 3 arsenical compound series in conjunction with 3 bismuth series, and 4 injections of his fourth arsenical series. This patient complained of pain in his gums. A very marked discoloration of the gingival tissue following concentrated bismuth therapy was present, and examination confirmed the diagnosis of Vincent's gingivitis, acute.

Case 3.—A steward's mate, second class (colored), age 22 years, had been under treatment for syphilis for more than 1 year. Treatment consisted of 3 arsenical and 3 bismuth series, plus 9 doses of a fourth arsenical series. His health record showed that he had been isolated in the sickbay with Vincent's angina during the period when he was receiving arsenicals. Study of daily smears from the gingiva showed the presence of Vincent's organisms, but clinical evidence of an active Vincent's infection of the gingiva was absent 4 weeks subsequent to the attack of Vincent's angina.

Case 4.—A fire controlman, third class, age 24 years, had received the so-called 5-day antiluetic treatment, in which the arsenical equivalent of 32 weeks' treatment was administered during a 5-day period. His oral hygiene appeared exceptionally good. He wore an upper partial denture. Daily smears showed Vincent's organisms to be present microscopically, but clinical evidence did not warrant a diagnosis of active Vincent's gingivitis.

Case 5.—A fireman, first class, age 23 years, had also received the 5-day antiluetic treatment. Study of smears taken from the gingival tissues during the 5-day treatment and at the termination of treatment confirmed the presence of Vincent's organisms. The diagnosis of Vincent's gingivitis is not warranted in this patient because of lack of clinical evidence, but the presence of large numbers of Vincent's organisms is noteworthy.

SUMMARY

Several patients receiving regular weekly or biweekly injections of bismuth and arsenical compounds were found to have Vincent's gingivitis, either in an acute or chronic form. In other syphilitic patients receiving the same treatment, Vincent's organisms were found upon microscopic study of the gingival exudate, although there was no clinical evidence of Vincent's gingivitis. Of the latter patients 2 had received the so-called 5-day antiluetic treatment, in which the arsenical equivalent of 32 weeks' treatment is given during a 5-day period. Confirmatory clinical evidence of active infection was lacking in these 2 patients.

CONCLUSIONS

1. The intravenous administration of arsenical compounds is not uniformly efficacious in the treatment or prevention of Vincent's gingivitis.

2. The use of large quantities of a heavy metal (bismuth) does not prevent the development of Vincent's gingivitis, nor is it an effective therapeutic agent in this disease.

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X-RAY THERAPY AT A FOREIGN SHORE STATION

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Considering the fact that naval personnel is predominately composed of young men between the ages of 18 and 25 years, it is apparent that x-ray treatment will be devoted almost entirely to benign conditions. Malignant tumors for the most part are confined to the older group of officers and enlisted men who have been in the service for a considerable number of years.

The x-rays available for therapy at this station are produced by 85 kv. and up to 5 ma., filtered with aluminum. This quality of treatment is referred to as superficial x-ray therapy. At this station the rays are generated by a diagnostic unit that can be used only a limited time each day. No x-ray therapy had been used here until about 2 months before this series began. A total of 348 patients have been treated over a period of 5 months.

By far the most prevalent condition subjected to treatment was epidermophytosis. It involved principally the hands and the feet, but occasionally other areas of the body were affected. A large number of such infections were managed medically without the use of x-ray therapy. However the cases that appeared to be resistant to the use of medication and those that showed particularly extensive involvement, were treated with x-ray therapy. The usual amount of treatment consisted of 50 r.

The second most common condition was cellulitis. The amount of therapy given was either 25 or 50 r depending upon the extent and severity of the infection; the smaller amount was prescribed for the more acute as well as for more generalized conditions.

Folliculitis is surprisingly common in the tropics probably because of the warm weather and resulting perspiration. The usual treatment consists of 50 r.

Carbuncles are seen in all variations of climate but are probably less common in the tropical than in the temperate zone. The treatment consists of from 50 to 75 r depending upon the acuteness and extent of the infection.

Boils should be treated with x-ray as soon as they are seen. A dose of 50 r hastens localization of the infection when it is in a cellulitis stage and thereby hastens fluctuation. A second treatment may be given 24 to 48 hours later.

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Warts can be treated in a number of ways but when it is necessary to keep the skin intact in order that the patient may continue his usual duties, x-ray therapy is the treatment of choice. The treatment consists of 200 to 300 r at a 20 cm. focal skin distance. Increased distances can be used if necessary.

Plantar warts are managed in a similar manner except that the dosage is 300 to 400 r. In most instances the distance can be as short as 20 cm.

Impetigo is a condition which is rarely treated with x-ray therapy. When the usual progress with medication is not made, x-ray therapy is frequently of assistance. The amount of treatment used is 50 r at a 20 cm. focal skin distance.

Pruritus ani cases are generally benefited by x-ray therapy in doses of 50 to 100 r applied directly to the pararectal area. This treatment may be repeated 3 or 4 times at 4- to 8-week intervals.

Ear canal infections including boils and mycotic lesions occur not infrequently. They are given doses of 100 to 150 r with satisfactory results. The increased dose of x-ray therapy is given because of the depth of the lesion.

Acne is difficultly amenable to x-ray. Adequate treatment for this condition usually requires a dose of 250 r or more. This amount of x-ray given to a large area of skin results in definite and permanent skin damage so that subsequent degeneration of the skin is likely to occur. However, if a small localized area is involved, 200 to 300 r can be given with benefit.

Herpetic lesions including herpes zoster and herpes simplex are usually entirely eliminated by x-ray doses of 50 to 100 r. The lesions dry up within a few days and tenderness is usually gone within one day. Exceptions to this occur only rarely. Herpetic lesions involving the cheek, eye, or forehead respond in an equally satisfactory manner. When lesions involve the eyeball, treatment must be given to the whole structure. If the amount of treatment is kept to a minimum no appreciable damage to the lens will ensue.

Sebaceous cysts are usually not subjected to x-ray, but surprisingly good results have been obtained with a dose of 100 r, repeated if necessary once or twice at 2- to 4-week intervals.

Neurodermatitis responds well to x-ray therapy in the amount of 75 to 100 r.

Bursitis probably has a wider range of x-ray dosage than any other inflammatory condition. The acute primary bursitis is well treated with a dose of as little as 50 r while the old, long-standing chronic bursitis, such as the subdeltoid bursitis with calcification, responds more promptly and with more relief of symptoms to doses of 150 to 200 r.

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The few times that chronic dermatitis has been treated, relatively ood results have been obtained with doses of 50 r. The skin condi-ion in these cases was localized to one or two areas. The skin some-imes was reddened and thickened and sometimes spotted with small rusts.

Carcinoma of the skin can usually be well managed by a dose of 00 to 400 r. Three patients with carcinoma, one a young man, re-ponded very well to this treatment. The others were in the more dvanced age group but improved under the treatment. Treatment s limited to lesions which are not greater than 2 mm. in diameter. No ttempt is made to treat the larger lesions; the patients are transferred o the nearest naval hospital.

Hyperkeratosis has been encountered and satisfactorily treated with 50 to 400 r.

Paronychia is treated with 50 r. This treatment may be repeated n 24 hours.

Lymphadenitis of unknown etiology is treated with 50 r. This dose s repeated, if necessary, in 4 to 7 days.

Interdigital corns can be treated with x-rays only with difficulty. Ve have used 150 r on each of the anterior and posterior fields, cross-ring the tumor area.

Epidemic parotitis responds well to x-ray therapy in amounts vary-ng from 50 to 75 r. Surgical parotitis also responds to x-ray therapy n a similar amount.

Osteomyelitis is treated with relief of symptoms and subsidence of ctivity by giving 50 to 100 r and repeating, if necessary, every 4 to 6 eeks for a total of up to 6 treatments.

Seborrheic dermatitis is managed according to the acuteness of the ondition and responds well to a dose of 50 to 150 r, the smaller amount eing used for the more acute condition.

Myositis, of unknown origin, is treated with a dose of 50 r. The ne case we have treated reported relief of his pain within 24 hours.

Ludwig's angina usually responds well to a dose of 50 r. This con-ition usually requires two areas of treatment, the centers of which are bout the location of the submaxillary glands. Not infrequently his condition requires a second treatment at 24 hours and possibly a hird treatment at 48 hours.

Keloids respond well to 300 r. If necessary this dose may be re-eated in one month.

Otitis media has been treated using 100 to 150 r. This amount s used because of the depth of the disease and the density of the one.

Neuritis responds very well to a dose of 50 to 100 r with relief within 4 hours, although there first may be an exacerbation of the pain.

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Chronic granulomata are exposed to 75 r, but response to this treatment is seen only in about one-half of the patients. Larger doses might be of more benefit.

Within the past few years, the recognition of virus pneumonia has become widespread. When this condition is treated with x-ray at an early stage of the disease, a number of observers have reported good results with quite prompt relief of the aggravating cough and more rapid resolution of the pulmonary congestion. We have treated one such case using a dose of 50 r over the affected area. This treatment may be repeated 24 hours later.

Erysipelas responds well to x-ray therapy and doses of 25 to 50 r are given depending upon the acuteness of the condition. We have not encountered erysipelas at this station during the period of this survey, a fact which may be due to the use of sulfonamides.

There are numerous other conditions which can be managed with superficial x-ray therapy, and in general the doses will be comparable to similar diseases already mentioned.

High voltage x-ray therapy and radium are not available at this station and diseases requiring their use, therefore, cannot be treated.

When a patient presents himself for treatment and the lesion has been subjected to medical remedies a delay of 24 to 48 hours is made in order to insure complete removal of the medication. When x-ray treatment is given, no other medication should be applied for a period of at least 24 hours. Since x-rays and the rays of the sun have similar effects on the skin, the patient is warned to protect the treated area from the sun for a period of at least 1 month.

The foregoing material can be summarized by putting the information into tabular form. It is necessary to remember that the factors listed fit this particular station where equipment of a given capacity is present. On a number of occasions, we would have preferred to use other factors of voltage, distance, and/or filtration, but were unable to do so because of the limitations of the machine. Table 1 is presented as a specific summary of the conditions treated at this station.

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TABLE 1.—*Summary of treatments*

Disease	Dose	Preferred distance	Repeat	Time interval
Acne	200–300 r	25 cm.	No	
Bursitis	50 r	25 cm.	Once	1 week.
Carcinoma	300–400 r	25 cm.	Once	4 to 6 weeks.
Cellulitis	25–50 r	25 cm.	Yes	24 hours.
Corns, interdigital	150–250 r	30 cm.	Yes	6 to 8 weeks.
Cysts, sebaceous	100 r	25 cm.	Yes	2 to 4 weeks.
Dermatitis, chronic	50 r	20 cm.	No	
Dermatitis, seborrheic	50–150 r	20 cm.	No	
Ear canal infections	100–150 r	25 cm.	No	
Epidermophytosis	50 r	25 cm.	No	
Erysipelas	50 r	25 cm.	Yes	24 hours.
Folliculitis	50 r	25 cm.	No	
Furunculosis	50–75 r	25 cm.	Yes	4 to 7 days.
Granuloma, chronic	75 r	25 cm.	No	
Herpes	50–100 r	25 cm.	No	
Hyperkeratosis	250–400 r	20 cm.	Yes	3 to 6 months.
Impetigo	50 r	20 cm.	No	
Keloid	300 r	25 cm.	Yes	4 weeks.
Ludwig's angina	50 r	30 cm.	Yes	3 days.
Lymphadenitis	50 r	25 cm.	Yes	4 to 7 days.
Myositis	50 r	25 cm.	No	
Neuritis	50–100 r	25 cm.	Yes	2 weeks.
Neurodermatitis	75–100 r	25 cm.	Yes	4 weeks.
Osteomyelitis	50–100 r	30 cm.	Yes	4 to 6 weeks.
Paronychia	50 r	25 cm.	Yes	24 hours.
Parotitis	50–75 r	25 cm.	Yes	3 days.
Pemphigus	50 r	25 cm.	No	
Pruritus ani	50 r	25 cm.	Yes	6 to 8 weeks.
Seborrheic dermatitis	50–150 r	25 cm.	No	
Virus pneumonia	50 r	30 cm.	Yes	24 hours.
Warts	200–300 r	20 cm.	Yes	6 to 8 weeks.
Warts, plantar	300–400 r	20 cm.	Yes	6 to 8 weeks.

[Factors remaining constant for all the above treatments are: 85 kv.—5 ma.—1 mm. aluminum filter.]

SUMMARY

A general summary of the conditions treated can be made by breaking down the diseases into two general groups, namely inflammations and new growths. The inflammations are distributed between end points of acute and chronic, the very acute inflammation receiving the smallest dose. Anti-inflammatory treatment varies from 25 to 150 r. The treatment of new growths varies in amount between 150 and 400 r, and the choice of the amount is dependent upon the severity of the condition and the surface extent of the disease. The more severe the condition, the higher the dose; and the larger the skin surface that must be treated, the smaller the dose. Thus it can be said that a considerable amount of clinical judgment is necessary to balance such factors in the treatment of various diseases.

It is always necessary to remember that, by all known and demonstrable methods of evaluating x-ray therapy, the results are always destruction. Thus if x-rays always destroy, the amount of x-rays given any tissue should be the minimal amount that will bring about the elimination of the disease.

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RECENT DEVELOPMENTS IN INTRAVENOUS ANESTHESIA

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Eleven years ago I gave my first intravenous anesthesia in the clinic of Doz. Dr. Hellmut Kamniker, at the Allgemeines Krankenhaus in Vienna. This was for a case of endometriosis of the bladder (*1*) and we used evipan 20 percent (!) for 5 different cystoscopic examinations with perfect results. In the 3,000 and more cases (*2*) (*3*) (*4*) (*5*) (*6*) that I have seen since then there has been no death,[1] and the generally satisfactory results obtained with this type of anesthesia makes it, in my opinion, as valuable as any other single agent that we now have, including ether.

Every surgeon going into the field should familiarize himself with the technic of administering intravenous anesthesia. With this point in mind the present paper describes a technic which has proved satisfactory and should be helpful. Recent literature on this subject will be briefly reviewed.

Either pentothal or evipal may be used with equal success. Pentothal, a so-called ultra-fast acting barbiturate, has the formula (Na-ethyl-(1-methyl-butyl) thiobarbiturate) and is marketed in 1-gm. ampules as a white, or yellow-white crystalline powder. The ampule is large enough to permit the introduction of 20 cc. of water.

Preparation for use.—Introduce 20 cc. of sterile distilled water into the ampule and dissolve the crystals. If one employs barbotage with the syringe the solution of the crystals will be speeded up. This will now give a 5-percent solution (50 mg. to each cc.). A 2½-percent solution may be obtained by the addition of another 20 cc. of water. In combat areas, where syringes may be few and where water may be scarce, 5-percent strength may be used, but in my opinion

[1] Since writing this paper I have had one death under pentothal anesthesia. This occurred in a young colored man, who received a total of 1,350 mg. of pentothal in a period of 35 minutes. The operation was a minor one, done on the neck. This is more than the average amount given for such an operation in that length of time, although much larger amounts have been given in considerably shorter periods of time for many operations. It is probably well to consider half an hour as the minimum time in which 1,000 mg. should be given, although one simply cannot lay down hard and fast rules for using the drug, one learns only by experience.

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the 2½-percent solution is the better preparation. Delmonico (7) also prefers this strength of solution. In any case, it is more advantageous to confine oneself to the same concentration of pentothal. In my experience there has been, however, no death under evipan, evipal, or pentothal, in any strength, which could be attributable to the anesthetic.

Where possible, particularly when intravenous anesthesia is being used to any extent, "pentothal trays" should be set up in advance for sterilization in the autoclave. These trays should have in them all necessary items.

Technic of administration.—Induction with pentothal is the fastest of all known anesthetic agents. It is also the easiest and the most pleasant for the patient. The matter of inserting needles into veins is usually a simple one, although at times it presents considerable difficulty. With circumspection in the choice of vein, in the proper placing of the tourniquet plus stretching of the vein by traction with the left thumb, insertion of the needle will usually be quite easy. The malleolar veins are frequently used, especially when the surgeon is operating upon the head or upper extremity. In spite of the number of devices which have been described for holding the needle in the vein, and for holding the syringe, none can supersede the use of the anesthetist's fingers. A nurse or other assistant gives oxygen to the patient when indicated and retains the proper chin posture of the patient. It is most important that undivided attention be given to the patient during all intravenous anesthesia. The more important points to observe especially during induction are as follows:

1. Rate and depth of respiration.
2. Maintenance of a good airway.
3. The amount of pentothal used up to any given point, and the patient's reaction to it.
4. The patient's color.
5. The degree of muscular relaxation.

Blood pressure and pulse rate are less affected by intravenous than by any other anesthesia. Normal sleep is more readily simulated. It has been found that if a patient fails to get his premedication, he will require from 20 to 50 percent more pentothal than he would have with proper premedication. Nembutal (grains 1½) the night before operation, as well as early on the morning of operation, will make induction and anesthesia smoother. Premedication with atropine and morphine is important.

Method of induction.—Select a vein and inject 3 cc. of the 2½-percent solution within 7 or 8 seconds. Then ask the patient to start

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counting slowly with you. Inject another 3 cc. in the next 60 seconds, and another 2 cc. in the following 30 seconds. At this stage (after 10 cc.) most patients will be asleep, 250 mg. or one-fourth of an ampule only having been used. Surgical anesthesia, however, will not have been reached except in rare cases. As a rule it is necessary to introduce from 14 to 16 cc. (total) into the vein within the first 3 or 4 minutes, before a surgical depth has been obtained. Occasionally 16 to 24 cc. of the 2½-percent solution will be required. In certain minor operations (as for example opening of abscesses) deep anesthesia will be unnecessary.

Pentothal fortunately creates an amnesia and it is most unusual for patients to remember anything about their induction with this drug even though they may move and perhaps speak. There is no doubt but that the effect of pentothal is cumulative, and the longer the patient is under the drug, the less he will need. Young, strong patients will require a good deal more than weak, sick, or elderly people, sometimes two to three times as much.

One can often tell by the patient's voice how the pentothal is affecting him. It will become weaker and slower. Just before surgery is to begin, injection of another 2 cc. will forestall all reflex response. The syringe can be detached when it is empty without any difficulty, and a second, third or even fourth syringe may be attached in turn if indicated. It must be remembered that each syringe contains 500 mg., and the drug should be thought of in relation to that amount in each syringe. The dosage given should be recorded in milligrams and not in cubic centimeters.

When the patient is surgically anesthetized, breathing will almost always be abdominal, and usually very shallow. An ordinary pharyngeal airway is usually inserted after the patient has reached a sufficiently deep stage of anesthesia. The rate of administration of pentothal intravenously depends upon the degree of relaxation required, the health of the patient, the depth of respiratory depression observed up to any given point in the anesthesia, and the color of the patient. To this may be added the length of time that the procedure may be expected to take, and the depth of pain associated with the particular operation.

Table 1 shows in brief the relationship of anesthesia to the surgery applied in 20 cases.

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TABLE 1.—*Relationship of anesthesia to surgical procedure*

Surgery	Duration of operation	Age of patient	Weight of patient	Amount of pentothal
	Minutes			*Milligrams*
1. Suture of 6 lacerations and reduction of fractured humerus following air accident	48	24	160	1,325
2. Dilatation and curettage of uterus	9	55	112	550
3. Encephalography	20	31	178	825
4. After spinal anesthesia began to wear off (last 15 minutes)	90	21	140	425
5. Resection of four ribs and exploration of empyema cavity	130	42	128	2,625
6. Cystoscopy	5	40	195	750
7. Recession of muscles of eyes	55	26	200	2,150
8. Dermatome skin graft for old burn	105	28	152	1,675
9. Colostomy	34	66	140	825
10. Fistula-in-ano	18	25	175	900
11. Amputation of 2 toes	28	60	150	775
12. Reduction of dislocated humerus	5	42	165	700
13. Ludwig's angina	7	33	174	675
14. Osteomyelitis, mandible	25	59	170	925
15. Gastroenterostomy (with local block)	65	47	162	1,125
16. Transurethral prostatic resection	40	68	154	950
17. Incision and drainage of axillary abscess	7	21	148	750
18. Reduction of broken nose	6	19	170	700
19. As induction before ether	5	41	144	400
20. Removal of pack from posterior resection	2	61	138	225

Randolph and Kober (*8*) report that in 123 thoracoplasties on 53 patients they used pentothal with excellent results, using from 1,200 mg. minimal to 2,500 mg. maximal. Thomas (*9*) finds that pentothal is to be recommended for general anesthesia in operations upon the sinuses, mastoids, nasal septum and larynx. For pentothal depression postoperatively he recommends picrotoxin 1 cc. intravenously every 20 minutes until slight twitching occurs, then 1 cc. every 3 hours intramuscularly for two or three times. I have used both picrotoxin and metrazol. The latter is given in the same manner as that just indicated for picrotoxin. According to Lundy and Tuohy (*10*), who have done much work with pentothal, the administration of 50-percent nitrous oxide with 50-percent oxygen during intravenous anesthesia will stimulate breathing and will act synergistically with pentothal. Paquet (*11*), like Randolph and Kober, believes pentothal to be the anesthetic of choice for thoracoplasties, and he points out that with pentothal use of the electrocautery is free of danger, and is of considerable advantage in certain cases. Lundy and Tuohy also state that in their opinion pentothal is not satisfactory for normal deliveries. However, according to Rucker (*12*) pentothal was used in 101 obstetrical and gynecological cases without ill result. Lundy and Tuohy have used pentothal in cesarean section, preceded by local block in the abdominal wall.

Krueger (*13*) believes that pentothal is the anesthetic of choice for tuberculous patients. There has been some comment on the use of intravenous anesthesia in Ludwig's angina, and according to Williams and Guralnick (*14*) the mortality was cut from 54 to 10 percent. Other factors, however, were involved. Of 20 cases operated upon under pentothal only 2 died.

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Hunter (*16*) in England reports the use of pentothal per rectum, as do Weinstein and Light (*17*) in this country. Hunter thought that pentothal was less variable in action when given by rectum than it is when given by vein. I do not concur in this opinion. Weinstein and Light administered the agent rectally to 1,500 cases as a basal anesthetic, either cyclopropane or ether being used by inhalation. Basal pentothal before spinal anesthesia is considered by them a good form of anesthesia.

British anesthetists are accustomed to introduce 500 mg. of a 5-percent solution of pentothal (10 cc.) directly into the vein in the first 40 seconds. If the patient were to become too depressed, resort to artificial respiration, an endotracheal tube, 100-percent oxygen, and picrotoxin or metrazol intravenously should usually be effective. Fortunately these instances are quite rare. Whenever pentothal is given for a period of more than 10 or 15 minutes, oxygen should be administered from the start of the operation. One of the best methods is to introduce into the patient's nostrils a Y-tube, chromium plated, which can be strapped onto the forehead, and kept conveniently out of the operative field. Oxygen may occasionally be advisable from the start. Pentothal should not be given after severe hemorrhages; several deaths have been reported following use in these instances. Pentothal has been given in conjunction with spinal anesthesia, either at the beginning of operation, to allay nausea, or excitement, or at the latter part to carry the patient through when the effect of the spinal agent has worn off. Usually large amounts of pentothal are not needed under these circumstances.

Surgeons should be reminded of the great value of pentothal sodium during minor operations. It is particularly suitable for burn dressings. A few milligrams of the drug in these cases will do much toward keeping the patient comfortable.

Swanson (*18*) reports the use of pentothal in detecting a case of malingering. The patient, who feigned lack of hearing, answered questions correctly while coming out of his anesthesia.

French (*19*) has a very fine and complete article on the subject of pentothal anesthesia and he reports its use in 837 cases. There were no deaths, but French does state that two deaths occurred when the drug was administered to patients undergoing minor surgery. The exact part played in these deaths by pentothal could not be accurately ascertained.

SUMMARY

1. Intravenous anesthesia has now been proved to be as valuable as any other known anesthetic agent, including ether.

2. In war surgery intravenous anesthesia, in its general usefulness, leads all others.

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3. The technic of administering intravenous anesthesia should be kept as simple as possible.

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THE USE OF SODIUM PENTOTHAL WITH NITROUS OXIDE-OXYGEN-ETHER ANESTHESIA

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As spinal, regional and intravenous anesthesia become more commonly used in military surgery, inhalation anesthesia becomes of relatively less importance. There are situations however, where inhalation anesthesia is indicated, and improvements in administration need consideration.

During inhalation anesthesia the period of induction through the analgesic and excitement stages may be difficult. This has been somewhat overcome in civilian practice by the use of ethylene or cyclopropane. It is not practical in many military operating rooms to have these gases available. The patient who has not been in active combat presents no greater problem during the induction period, using nitrous oxide and ether, than does the civilian patient of similar age and vigor. But in spite of heavy premedication the patient who has been in active combat is often difficult to handle when nitrous oxide and ether alone are used.

One can use pentothal to obtain a rapid, quiet induction, followed by nitrous oxide and ether. Premedication is important and must be determined by the patient's condition. The usual premedication was morphine grain ¼, with atropine grain 1/100 given 1 hour preoperatively. No barbiturate was given at this time. Intravenous morphine and atropine in the same dosage is well tolerated even when given a few minutes prior to the operation.

After arranging the patient and the gas machine for inhalation anesthesia, the patient was first anesthetized with sodium pentothal. A 5-percent solution was used. A 2½-percent solution would be as effective and is considered by some to be safer. The initial dose was 2 to 3 cc. given at the approximate rate of 1 cc. per second. After observing the extent of respiratory depression, 1 to 2 cc. were added if the breathing was not greatly depressed in volume or rate. After 4 to 5 cc. were given the patient was tested for anesthetic depth by pinching the lobe of the ear, using finger and thumb nails to elicit pain if possible. If there was response to this stimulus, 1 to 2 cc. were added and the mask adjusted to the patient's face.

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The procedure from this point on was not unlike the usual nitrous oxide, oxygen and ether induction except that high concentrations of nitrous oxide were avoided. Immediately following the last injection of pentothal, the patient was given a mixture of nitrous oxide 75 percent and oxygen 25 percent, with which the gas bag of the machine had been previously filled. The exhale valve was opened and the flowmeters of a Heidbrink machine set at 1,000 cc. per minute of nitrous oxide and at 300 cc. per minute of oxygen. A McKesson, Connell, or Foregger machine can be used as well for this purpose. After 6 to 7 breaths of this mixture the gas bag was emptied of the nitrogen excess and quickly refilled with approximately the same percentages of nitrous oxide and oxygen. After 8 to 10 breaths the bag was again emptied and refilled as before. If the patient showed signs of waking and the skin color continued good, a greater percentage of nitrous oxide was used. Ether was slowly added 3 to 4 minutes after the nitrous oxide and oxygen had been started. When the ether was added, nitrous oxide was decreased to allow a flow of nitrous oxide and oxygen in equal parts. It was found that at least 5 minutes, and usually longer, were required from this point on before surgery could be started. As soon as it was found that a weak concentration of ether was tolerated the nitrous oxide was discontinued, the exhale valve closed and oxygen set at a maintenance rate of flow. As the ether concentration was increased, coughing sometimes occurred. This cough was eliminated as readily by emptying the bag and refilling with nitrous oxide and oxygen as if pentothal had not previously been given. No laryngeal spasm was encountered during the gradual increase of ether concentration. It was found best to insert the oral airway just before surgery was started rather than during the period immediately following the pentothal. Just as during induction where pentothal was not used, the eye and chest signs determined when the patient was ready for surgery. It was noted that at no time following the pentothal were the respirations as deep as during inductions where pentothal had not been used. For this reason initial concentrations of nitrous oxide over 75 percent were avoided. The somewhat shallow breathing also necessitated a slower addition of ether than if the pentothal had not first been given.

There are disadvantages to this use of pentothal. There is the risk always met when administering pentothal. Cardiac, respiratory, hepatic, luetic, or allergic disease contraindicate its use. With this method, as when avertin is given prior to inhalation anesthesia, the patient drifts from one plane to another more quickly than expected. He may become somewhat lightly anesthetized or unnecessarily deep.

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However, the eye movements, pupillary changes and chest signs maintain their characteristics well enough to prevent extremes of anesthetic levels. Prompt postoperative response and postoperative vomiting occurred in the same ratio as if the pentothal had not been used.

The advantages of pentothal as used above, for surgeon, anesthetist and patient outweigh the disadvantages that have been discussed. No struggling occurred in 30 consecutive cases.

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REMOVAL OF SULFONAMIDE INHIBITORS IN DENTAL WORK

The inhibitory effect of para-aminobenzoic acid on the bacteriostatic action of the sulfonamide group of drugs can be reduced by thoroughly ridding the mouth wound of purulent material and by irrigation.

Sulfathiazole, since it is a fairly insoluble agent, is present in saturation long after procaine is excreted. At any rate, the action of the small dose of procaine employed in dental operations does not appear to neutralize the beneficial action of sulfathiazole.—Stein, A. H.: Prophylactic value of the sulfonamides in traumatic dental surgery. J. Am. Dent. A. 30: 1918–1922, December 1, 1943.

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EFFECT OF TYROTHRICIN ON ORAL BACTERIA

A study of the bactericidal power of tyrothricin on oral bacteria has been carried out *in vitro*. Organisms used were isolated from specimens of saliva, from root canals and from periapical abscesses. The tyrothricin, in the presence of 10 percent glucose, was found to be effective against gram-positive organisms when its concentration was 0.06 mg. per cubic centimeter or greater. Its bactericidal action was usually at a maximum at the end of 4 hours. It had a tendency to be more effective against streptococci than against the other organisms tested. Whole saliva partially inhibited the bactericidal power of tyrothricin.

At the concentration just mentioned, the action of tyrothricin inhibited the motility of spirochetes. A tenfold concentration was necessary for bacilli and vibrios.

When tyrothricin was applied locally on mucous membranes, it was found to be nontoxic for guinea pigs and in the one human case tested.

Tyrothricin given intraperitoneally in the quantity of 0.015 mg. protected mice against 0.5 cc. of whole saliva given in the same manner. This dose was ineffective against 1 cc. of mixed saliva.—Johnson, F. G.: Studies on gramicidin and related substances; bactericidal effect of tyrothricin on oral bacteria. J. Am. Dent. A. 30: 1909–1914, December 1, 1943.

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POSTOPERATIVE PULMONARY ATELECTASIS

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Today the most common complication of abdominal surgery is pulmonary atelectasis. Although the condition was suggested by Gairdner (*1*) as early as 1850, it was first recognized as a postoperative clinical entity by W. Pasteur (*2*) some 60 years later. His observations were based on postdiphtheritic patients with paralysis of the diaphragm, and he logically concluded that the condition was due to decreased inspiratory force. Lee and Jackson (*3*) in 1925 were the first to demonstrate bronchoscopically the complete obstruction of a bronchus with thick, tenacious bronchial secretion.

It is rather generally agreed that the primary causes of postoperative atelectasis are insufficient pulmonary ventilation and inadequate endobronchial drainage. The fundamental factors however are painful, splinted chest expansion, excessive viscidity of the bronchial secretions, and inability of the patient to eliminate these secretions.

PATHOLOGIC PHYSIOLOGY

Operative wounds, particularly upper abdominal and kidney wounds, cause pain on deep inspiration and upon coughing. Inspiratory force and lung expansion are consequently restricted because of the pain, and for the same reason the force of an expulsive cough is restrained. The amount of moisture carried off with each expiration may be observed by the frost seen when breathing in a cold atmosphere. If a segment of lung is not being properly aerated, this moisture tends to collect in the bronchial tubes. If, moreover, viscid mucus is allowed to accumulate during the anesthesia an obstructing bronchial plug may develop. This condition is often promoted by the injudicious use of preanesthetic drugs and faulty management of the postanesthetic patient. These circumstances are magnified if the patient has a latent chronic bronchitis.

The pathologic physiology of pulmonary atelectasis is therefore easily understood. There is mucus in the bronchial tube. It is allowed to accumulate because of incomplete chest expansion, which effects incomplete lung aeration and suppresses the cough reflex. Finally the thick mucus plugs a bronchus. The plugged bronchus, according to Carlson and Luckhardt (*4*) and others, then goes into

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spasm which further increases the obstruction. As no more air can enter the segment of lung involved, the air already there is quickly absorbed into the blood stream. Hence a negative pressure is created in the involved lung affecting the respiratory excursion on that side of the thorax. The heart and mediastinal structures are retracted toward the involved side, the diaphragm is pulled upward and the intercostal spaces are narrowed. Should bacterial contamination occur around and behind the plug, postoperative pneumonia becomes inevitable. Thus the importance of early recognition of atelectasis is apparent.

SYMPTOMS

Characteristically, pulmonary atelectasis makes its appearance within 48 hours after surgery but may appear 10 or 12 days after operation. The onset usually is sudden but may be insidious and is sometimes accompanied by a chill. The most constant finding is an abrupt rise in temperature, pulse, and respiratory rate. Dyspnea and cyanosis may be present. Pain in the chest is not common. There is usually a desire to cough; the cough at first may not be productive, but later a thick, tenacious sputum appears.

The severity of the symptoms and findings, however, are dependent upon the extent of lung tissue involved. Massive atelectasis (massive collapse) where a lobe of the lung or even the entire lung is affected produces alarming symptoms. Again, not infrequently multiple small areas of atelectasis will be found in either lung—bilateral so-called patchy atelectasis. In such cases the physical findings will be variable and may change from hour to hour. The most common physical signs of value are those which have been mentioned. The findings on palpation, percussion and auscultation are extremely variable and depend upon the size of the involved area and the degree of bronchial obstruction present. This led Brunn and Brill (*5*) to state "the chief characteristic of the physical findings is their variability."

Often the physical signs are indistinguishable from those of bronchopneumonia. It therefore becomes apparent that bedside x-ray of the chest is of the utmost importance in the early recognition of atelectasis and should be done routinely in suspected cases. Although the x-ray appearance of multiple, patchy atelectasis is difficult to distinguish from pneumonia, the more common lobular or lobar variety is easily recognized. The mediastinal shift, elevation of the diaphragm, narrowed intercostal spaces and the nonaerated lung segment sharply demarcated from the adjacent normal or hyperventilated lung are characteristic findings. Leukocytosis of 15,000 to 20,000 is common. The sputum may be very scanty or extremely profuse and frequently contains a pneumococcus.

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Adams (*6*) has listed aids in the diagnosis as "(1) awareness of incidence after abdominal operations; (2) time of onset—24 to 48 hours after operation; (3) sudden rate of development and severity of symptoms; (4) shift of heart and mediastinal structures found on physical and x-ray examination; and (5) bronchoscopic finding of bronchial obstruction." Suspicion of its existence is the most important single factor in the early diagnosis of pulmonary atelectasis.

TREATMENT

Since atelectasis is the primary lesion in most postoperative pneumonias, its prevention is of the utmost importance. Meticulous attention to the etiologic factors will do much toward this end. Inasmuch as excessive bronchial secretion is a major factor, every effort should be made to obtain adequate tracheobronchial drainage prior to surgery. Elective operations should be postponed in the presence of an acute upper respiratory infection. In the presence of a bronchitis or bronchiectasis the secretion should be reduced to a minimum before surgery is undertaken.

The anesthetic of choice should be the one which abolishes the cough reflex and interferes minimally with the muscles of respiration. The Trendelenburg position during and immediately after operation aids in the gravity drainage of bronchial secretions and helps to guard against the aspiration of regurgitated gastric contents. Frequently changing the position of the patient in bed during the first few postoperative days reduces the likelihood of this complication. Since atropine and hyoscine tend to dry secretions, making them more tenacious and difficult to eliminate, Mathes and Holman (*7*), Adams (*6*) and others advise against their use even when secretions are excessive.

Spinal anesthesia, particularly at the higher levels, paralyzes many of the accessory muscles of respiration with resultant shallow breathing during the period of anesthesia. This constitutes one of the chief objections to the maintenance of prolonged spinal anesthesia by the use of such agents as pontocaine hydrochloride, nupercaine, and the so-called "continuous spinal anesthesia." During the spinal anesthesia, regardless of what intraspinal agent is used, it is important that the patient be given inhalations of carbon dioxide and oxygen frequently to insure adequate and complete expansion of the lungs.

Once atelectasis has occurred, prompt and occasionally heroic measures must be instituted if the sequelae of pneumonia and lung pathology are to be prevented. Tracheobronchial drainage is the prime requisite of successful treatment. The cough reflex is the

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natural body response for removing foreign material and secretions from the bronchial tree. Coughing should be encouraged by every means at our command.

Frequent inhalations of 5-percent carbon dioxide and 95-percent oxygen, or routine insistence upon deep breathing also stimulate coughing. A procedure which has proved most successful in our hands is to turn the patient onto the unoperated side and, with a snug abdominal binder in place and with his wound additionally supported with his own or a nurse's hands, the patient is instructed to cough. As he coughs the involved side of the thorax is suddenly and forcibly compressed by the physician's hands which are placed on the front and back of the chest. By this method we have frequently dislodged a bronchial plug with prompt relief of symptoms.

If these methods are not successful, aspiration of the affected bronchus through a tracheal catheter with or without a bronchoscope should be done. If the bronchial tube is promptly cleared, symptomatic improvement is sudden and dramatic with disappearance of the dyspnea and cyanosis, subsidence of the rapid pulse rate and respirations, and lowering of the temperature.

Chemotherapy with one of the sulfonamides should be instituted early in all cases of atelectasis as a prophylactic measure against pneumonitis, pneumonia, and lung abscess.

REVIEW OF CASES

For purposes of this study 210 consecutive major abdominal and kidney operations were reviewed. In this group there were 11 patients who developed postoperative pulmonary atelectasis, proved both clinically and roentgenologically, an incidence of 5.2 percent. Several cases were excluded because of negative clinical or x-ray findings. This incidence compares favorably with several reported series of similar operations but is, nevertheless, too high.

As all of our patients were males, the sex factor does not enter except that atelectasis is known to be twice as common in males as in females. The youngest patient in this series was 19 years, the oldest 44 years, with an average age of 30 years.

Classified as to type of operation, there were 4 inguinal herniorrhaphies, 3 upper abdominal operations (gastric resection, cholecystectomy, jejunal obstruction), 2 pelviolithotomies, 1 appendectomy, and 1 removal of lower abdominal adhesions. Both kidney patients developed atelectasis on the unoperated side. This follows the rule laid down by Schmidt, Mousel and Harrington (*8*) and is probably due to dependent gravity drainage to the side upon which the patient is lying during operation. Otherwise there was no apparent relationship between the operative site and the location of the atelectatic lesion. In 9 of the 11 cases 1 lower lobe was involved, 5 on the right

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and 4 on the left side. In 1 case the right upper and left lower lobes were involved and in 1 the right middle lobe only.

Some interesting observations can be made as to the type of anesthetic used, although the series is too small to justify conclusions. Of the 210 cases, 191 were given spinal anesthetics, 16 inhalation anesthetics exclusively, 2 pentothal intravenously, and 1 a local infiltration anesthetic. Of the 191 patients receiving spinal anesthetics, 117 had a procaine-pontocaine mixture and 74 had procaine hydrochloride alone. In the procaine-pontocaine group (over one-half the total patients) 9 of the 11 atelectases occurred. In the procaine hydrochloride group (35 percent of the total) there was only 1 atelectasis. Schmidt, Mousel, and Harrington have called attention to the disadvantages of prolonged spinal anesthesia, particularly at the higher levels, because of the prolonged paralysis of the accessory muscles of respiration. The duration of anesthesia from pontocaine hydrochloride is two to three times that from procaine.

Nine patients developed atelectasis within 48 hours of the operation, one on the sixth and one on the eighth postoperative day.

All the patients in this series showed an abrupt rise in the temperature and in pulse and respiratory rate. In only one instance did the temperature fail to reach 102° F. and several were above 104° F. In only one case did the pulse rate stay below 100 and in several it was above 140. In all cases when the bronchial obstruction had been relieved, the temperature, pulse, and respirations returned rapidly to normal or nearly normal.

All of our patients recovered satisfactorily without a single instance of residual pulmonary trouble. They were all treated with conservative but vigorous measures, such as forced deep breathing, forced coughing with thoracic compression by the hands of a physician or nurse, and frequent, forced change of position. Three patients required aspiration by tracheal catheter, but none needed bronchoscopic aspiration. Sulfonamide therapy was initiated promptly in each case and continued until all clinical symptoms had subsided. This may be one of the reasons why none of the group developed pneumonia.

SUMMARY

1. Pulmonary atelectasis is the most common complication of major abdominal and kidney surgery.

2. Pulmonary atelectasis is known to be due to decreased pulmonary ventilation and inadequate bronchial drainage. Therefore, meticulous attention to details before, during, and after operation, is essential in preventing this complication.

3. A sudden rise in temperature and rate of pulse and respirations within 48 hours of operation is suggestive.

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4. Atelectasis promptly recognized and promptly and properly treated usually responds rapidly and satisfactorily.

5. Eleven cases are analyzed.

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MISTAKES IN OPHTHALMOLOGY

Errors in the treatment of diseases of the eye are less frequent than errors in diagnosis, because the number of drugs on the market is limited, and the indications for their application in most cases are sharply defined. Indeed, in the therapy of diseases of the eye, early diagnosis constitutes half of a successful treatment.

Nature repairs inflammatory or traumatic defects in the body by exudation and granulation, the end-results being scars and adhesions. In general medicine this end-stage can be considered a cure, as scars or adhesions do not necessarily interfere with the function of an organ or cavum. The ophthalmologist, however, must prevent, if possible, the formation of scars and adhesions, because even a cured eye is worthless if it cannot see. Therefore he must recognize ocular conditions in their early stage and employ such treatment as is indicated.

If any inflammation is present in the eye, it is not advisable to dilate the pupil until the absence of glaucoma has been definitely determined.—Staff of Greens' Eye Hospital, San Francisco: Some mistakes in ophthalmology. Bull. Pract. Ophth. 3: 36–39, November 1943.

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TREATMENT OF COMPOUND FRACTURES ABOARD A HOSPITAL SHIP

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Compound fractures represented approximately 10 percent of the casualties received aboard this hospital ship from the Solomons' campaign. Their care presented problems that had not been encountered in civilian practice. A modification of surgical methods was made to meet the demands imposed by construction of the ship, type of wound, danger of spreading infection, existence of foreign bodies, facilities for fracture reduction, and immobilization for rapid evacuation and transportation. The observations recorded and the technic employed in dealing with these problems are presented with the hope that they may be useful to others confronted with similar compound fractures resulting from military engagements.

Problems encountered in treatment of fractures aboard a ship.—The construction of a ship presented problems in fracture treatment not encountered in a hospital ashore. These were narrow passageways, ladders, bunks, and the use of litters. Plaster of paris casts and apparatus, therefore, had to conform to previously calculated measurements. Since the ship was under way most of the time, the immobilization employed had to be so thorough that a constant vibration of the ship's engines, or a total roll of 45° would cause no disturbance at the fracture site. The use, therefore, of any type of weight and pulley traction was excluded. Furthermore, the number of patients with extremity fractures (the number of fractured femurs alone ranged from 6 to 22 at a time) precluded the use of balanced traction, as there were only 2 beds available for a fracture frame. Finally, the patients had to be movable without adjustment of their dressings. The ship was operating in a combat area, hence the possibility of abandoning ship at any time and getting patients into boats or on rafts had to be considered. At the evacuation port the patients had to be moved by

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stretcher, boat, ambulance, or train to a hospital or transport vessel. These considerations led to the selection of the "pin and plaster" method in the immobilization of most of the compound fractures of the extremities.

General picture of the fracture material.—Four to five hundred patients were taken aboard the ship in from 3 hours to 3 days depending upon the patient load being received from one or several harbors. The fractures were from 1 day to 4 weeks old, but the great majority were seen 3 to 10 days after injury. The bones of the lower extremities were most frequently involved, but no bone was found to be exempt.

The patients had received primary treatment which varied from simple battle dressing to a cleaned wound with sulfanilamide powder and adequate splinting or cast. Occasionally patients arrived from vessels where destruction of medical facilities or numbers of casualties permitted only extemporaneous dressings. Others arrived by air transportation several hours after being wounded. Many fractures of the lower extremity had only windlass traction over a shoe, or a hitch about the ankle; a few had Steinmann pins through the femoral or tibial condyles or os calcis with traction through a stirrup to the end of the Thomas splint. Many fractures of the arm and lower leg received from transports and mobile hospitals were immobilized in plaster and required no further care while aboard.

Examination.—The compound fractures appearing to require immediate attention were assigned from the quarter-deck to one ward. Upon admission to this ward they were examined and an estimate of their condition was made from their first-aid tags, inspection of their wounds, temperature, pulse, respiration, blood pressure, hemoglobin, and leukocyte count. An attempt was made to determine the extent of nerve or vascular damage. This was frequently erroneous due to previously applied traction or tourniquet causing bizarre sensory changes; pain, preventing muscle function; and edema, masking pulsations of peripheral vessels.

X-ray films previously taken were transferred with the patient. At first there was some reluctance on the part of medical officers to surrender films which showed unusual fractures. The value, however, of keeping the films with the patient to facilitate decisions in treatment, avoid duplication of work, and save the patient from discomfort brought about by the extra moves in obtaining additional x-ray films was apparent and well appreciated by all concerned.

When films were not available observations were made of the fractures under the fluoroscope in order to determine the position of the fragments and presence of foreign bodies.

The selection of patients to be taken to the operating room was made on the basis of infection, adequacy of the dressing, relationship

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of foreign bodies to nerves and vessels and the position of the fracture fragments. Fractures of the lower extremity generally received precedence.

Anesthesia.—The patients were given ¼ grain of morphine sulfate approximately 1 hour before the scheduled time for their fracture reduction. Spinal anesthesia, using 120 to 150 mg. of procaine crystals was used for almost all fractures of the femur, and for a large percentage of those of the patella and lower leg. Many of the latter group and of the foot and ankle required no anesthesia. Most of the fractures of the upper extremity could be reduced and immobilized without anesthesia. When an anesthetic was necessary for the latter, intravenous sodium pentothal most often was used. Brachial plexus block was used in 6 cases. Intravenous anesthesia was used more frequently when there were multiple injuries, scattered foreign bodies to be removed from several regions or fractures in various parts of the body (table 1).

TABLE 1.—*Analysis of anesthesia used in 419 fracture reductions*

Fractured bone	Spinal	Local	Plexus block	Sodium pentothal	Gas-ether	None	Total
Upper extremity:							
Scapula and clavicle		2		2		10	14
Humerus		1		6	1	28	36
Forearm		10	5	16	1	42	74
Hand and wrist		11	1	3		27	42
Total for arm		24	6	27	2	107	166
Lower extremity:							
Pelvis	3					1	4
Femur	76			2	1	4	83
Lower leg	59	4		3		40	106
Patella	9	5				2	16
Foot and ankle	6	8		1		29	44
Total for leg	153	17		6	1	76	253

Treatment of wounds in compound fractures.—The wounds of practically all patients received had been treated by the local application of sulfanilamide or sulfathiazole. The drug was often found caked in the wound with dressings applied over it. The skin surrounding the wound was often crusted with dried blood and soiled with Diesel oil or dirt. Frequently, in spite of evident contamination in wounds 3 to 10 days old, there was a striking absence of inflammatory changes and signs of spreading infection. In the care of these patients the same plan of wound cleansing was followed as outlined in a previous publication.[1]

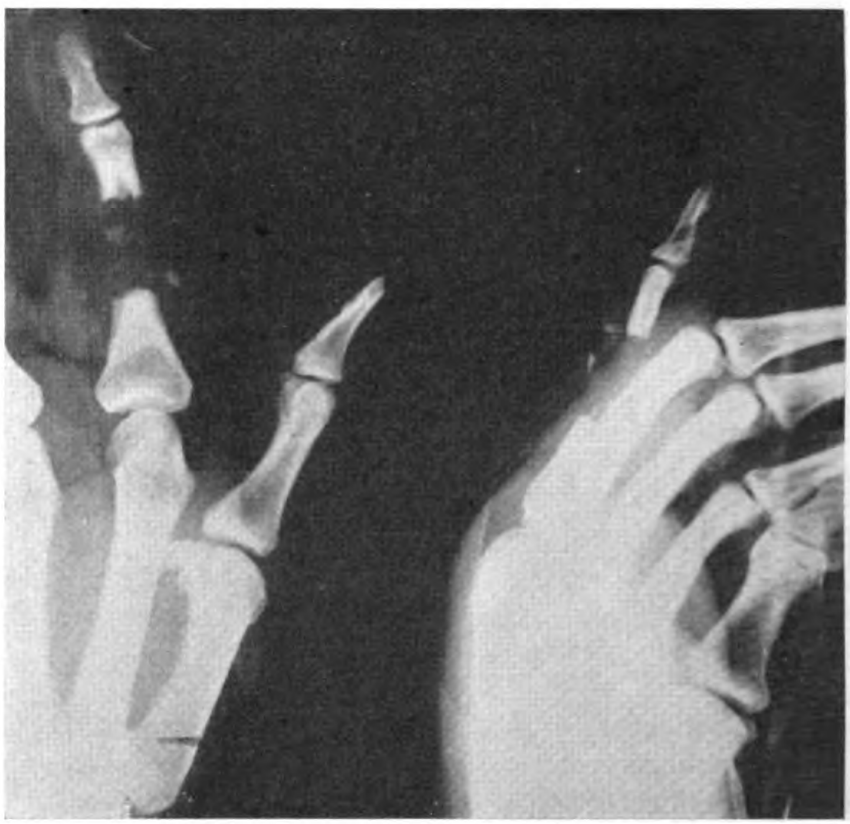
It was found that sulfonamide crystals which had been packed tightly in a wound occasionally acted as a plug behind which

[1] Ferguson, L. K.; Brown, R. B.; Nicholson, J. T.; and Stedman, H. E.: Observations on the treatment of battle wounds aboard a hospital ship. U. S. Nav. M. Bull. 41 : 299–305. March 1943.

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an abscess formed. Wounds that had been sutured, except those of the face, if of any extent, broke down or had to be opened to evacuate underlying abscess. The only secondary closures received on this ship that appeared successful were small wounds at the site of the foreign-body entrance. These would have, in most instances, crusted over and healed without suture.

Two cases were received in which forearm fractures had been wired and skin closure attempted. This position of the fracture fragments was not maintained by the wires. The wounds were broken down and the casts were so saturated with drainage that they were of no supporting value.



1. This is an example of early enthusiastic phalangeal debridement that can only result in deformity and nonunion. The defects created in tibia and humerus, and other long bones, were more distressing.

A few patients had encountered the attentions of ardent bone debridementers. These presented such extensive bone defects that belief in miracles must have been foremost in the surgeon's mind, if bone repair was expected (fig. 1).

Before treating the wound, the patient was placed in the position in which it was possible to immobilize and reduce the fracture. In fractures of the upper extremity, the patient was placed on his back with his arm supported in abduction by an assistant. In fractures

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of the femur, the patient was transferred to the fracture table and secured to the traction posts, while for fractures of the lower leg or foot he was generally left on the cart.

After fixation of the fracture by support or traction the dressings were removed. Sterile gauze was inserted into the wound. The skin around the wound and usually of the entire extremity was thoroughly washed with soap and water. Grease was removed with sponges soaked in gasoline. To save time, frequently two or three people were employed in this general cleaning procedure.

Following the skin preparation, the gauze pack was removed, and the wound or wounds irrigated with generous quantities of sterile saline solution. Sterile enema cans serve well as reservoirs and a rubber catheter attachment makes a good irrigating tip. During the irrigation foreign particles such as metal, dirt, grass, clothing and cocoanut fibers were meticulously looked for and picked out with forceps. Loose bits of devitalized tissue which floated in the irrigating stream were cut away with scissors. No metallic bodies which required opening spaces beyond the limits of the wound were disturbed unless they were directly beneath the skin (fig. 2). No bone fragments were removed unless they were free in the wound without periosteal or muscle attachment. If there was any evidence of abscess pockets, these were laid open through communicating fascial planes. Every precaution was observed to prevent bleeding in the wound area.

Wounds which bubbled gas were generally small. These were extended so that the skin wound corresponded in length to the involved underlying area. A similar counter incision through the fascial spaces was made down to the fracture site on the opposite or more dependent side of the extremity. Emphasis again was placed upon avoidance of hemorrhage from cutting directly through muscle. If there was subcutaneous gas in other areas of the extremity, these were opened by incisions through the skin and deep fascia. By retracting overlying muscles the spaces of the wound were exposed so that they could be thoroughly sprayed with microcrystalline sulfathiazole. In deep wounds with small surface openings such as those produced by through and through bullet injury, through and through irrigation was followed by the instillation of a 20-percent suspension of microcrystalline sulfathiazole or sulfadiazine. Vaseline gauze was laid loosely in the wounds. Gauze dressings were piled to conform with the wound outlines so that wound sites could be determined through the cast.

Plaster of paris casts.—The casts had to be designed for narrow passageways. As there was a lack of deck space, the patients had to be placed in their bunks before their casts were dry. The intense heat and humidity along with restricted ventilation was conducive to profuse sweating by the patient, which delayed the drying of the casts

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until a more temperate climate was encountered. The bunks were 76 by 28 inches, surrounded by a rail, and supported at either end by a chain. This construction made it difficult to move the patient and made it necessary to slide the cast when the patient was turned so that he would fit inside of the rail. This also meant that all legs and arms were restricted in abduction so that there would not be a spread greater than 26 inches.



2. Foreign bodies readily accessible through wound were removed. No bone fragments were disturbed. This type of fracture alined with gravity and required no pins.

The plaster bandages were applied directly on the skin surface. Felt strips were used at the cast margins and felt pads were placed about bony prominences. Skin surfaces with hair were greased with vaseline, as plaster setting about body hair proved very uncomfortable. Potassium alum was used in the water in which the plaster bandages were soaked to speed the plaster "setting." Heavily starched crinoline was found to retard the setting but had to be used when it was difficult to obtain any other material.

Upon admission decubitus ulcers were found most frequently over the dorsum of the foot from shoe or ankle traction, behind the os calcis, and in the popliteal space from the slings on the Thomas splint, and

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over the adductor tendon attachments in the groin from the ring of the Thomas splint. Only two sacral decubiti were observed.

Burn areas and decubitus ulcers were washed with saline, the slough trimmed, and sprayed with microcrystalline sulfathiazole. The plaster bandages were applied directly over the areas.

Two burn cases were skin-grafted by windowing the plaster cast over the granulating area.

Before the patient in the freshly applied cast left the operating room, an indelible pencil was used to mark the date of the injury and cast application, a diagram of the fracture, and the outline of the dressing overlying the wound. If the cast became stained within 24 hours a window was cut. This windowing, although criticized, was essential to preserve the casts from the secretions of large wounds which quickly softened them and caused their disintegration. Only the outside absorbent dressings of the wound were changed as frequently as they became saturated.

Femoral fractures—technic of reduction.—The patient with a fractured femur was brought to the operating room by a wheeled stretcher in the same Thomas splint in which he arrived on shipboard. The spinal anesthesia was given without moving the patient from the stretcher. By means of pillows placed along the side corresponding with the fracture and two additional pillows between his knees, he could be turned in the Thomas splint to lie on the affected side for the administration of the spinal anesthesia. This gave a greater concentration of the procaine on the involved side. The patient was then turned again on his back and the foot of the stretcher elevated about 10° until the anesthesia reached the desired level. When the anesthetic effect was obtained, the subject was lifted on the fracture table and the Thomas splint removed.

The skin surfaces were then cleansed with gasoline to remove the grease, and washed with green soap. If skeletal traction had not been applied prior to admission, the skin in the area to receive the pin was shaved and painted with merthiolate. The supracondylar area of the femur was chosen unless extensive comminution of the fracture, underlying abscess, overlying wound, or burn contraindicated, in which case the upper tibia was used.

Steinmann pins were used as it was possible to incorporate them in the cast, permitting removal of the stirrup after a few days. The stock of stirrups would otherwise have been quickly depleted. The legs were secured to the traction posts of the fracture table; the unaffected extremity by binding the foot, and the affected through the pin and stirrup unit. After care of the wound and application of dressing as described above, the alinement was checked by means of the mobile fluoroscope. The tendency for extensively comminuted fractures to aline with traction was remarkable (fig. 3).

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There were 75 fractures of the femoral shaft. In transverse fractures of the shaft, the spinal anesthesia greatly facilitated the relaxation of muscle necessary for reduction. In but two cases, one midshaft, the other supracondylar, a Steinmann pin was introduced into the fracture site to lever the bone ends into apposition. The remainder reduced with traction and manual pressure. A third simple trans-



3. Extensively comminuted fractures showing alinement obtained with traction on fracture table. Immobilization was by a double hip spica.

verse fracture with compound fractures of both lower legs could not be reduced, due to restriction of use of the x-ray apparatus at sea.

At first single hip spicas were used for immobilization of fractures of the femur. Skeletal fixation by means of pins in proximal and distal fracture fragments was deemed necessary. In six cases where wounds were overlying the upper fragment, a Steinmann pin was introduced through and in line with the crest of the ilium. In one case this pin was removed the third day because of infection. In the

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others discomfort resulted from motion between the pin and the plaster cast, and infection occurred when the pins had remained in the ilium 6 weeks.

As the single hip spicas failed to withstand the strain they were necessarily subjected to in moving the patient, double hip spicas were used for fractures of the lower two-thirds of the femoral diaphysis after the second evacuation of patients. With the pelvis immobilized, a pin in the proximal femoral fragment or crest of the ilium was not required.

Fractures of the upper third of the femur exclusive of the femoral neck, that were not extensively comminuted, were treated with well-leg traction. The flexion of the upper fragment was overcome by keeping the patient in a sitting position. As the wounds in the hip area were frequently extensive, this method facilitated the dressings that were necessary because of the profuse wound discharge.

As a temporary dressing the most satisfactory immobilization of the femoral shaft fractures was with a Steinmann pin through the condyles or upper tibia and traction maintained by a heavy elastic tourniquet to the end of a Thomas splint. The Hodgen splint because of its half ring became displaced from under the ischium and slipped laterally along the trochanter. Shoe and ankle traction if adequate resulted in pressure areas.

Fractures of the lower leg.—Fractures of the lower leg seldom had much displacement, as frequently one bone was intact. In those with marked comminution or obliquity of fracture line resulting in loss of length, Steinmann pins were placed in the upper and lower tibia. The os calcis was used as a pin site as an alternative only when the nature of the wound or fracture demanded it. After the wounds were cared for, the lower leg was permitted to flex at the knee over the end of the stretcher or table and traction was made on the distal Steinmann pin and the fracture alined (fig. 4). The fluoroscope was used to check position and the plaster cast applied below the knee, incorporating both pins. When this section of the cast had dried the knee was extended to 170 degrees and the cast continued to the groin.

The Roger Anderson apparatus was used for reduction in two cases of compound fracture of the lower leg, of 2 and 4 weeks' standing, with 1¼ and 1¾ inches overriding. Perfect reduction without circulatory embarrassment was obtained in each case. The apparatus was not used more frequently as most of the fractures reduced readily with simple traction through a Steinmann pin or a Kirschner wire, as extensive compounding of the wound left no skin area free of contamination for the two-pin unit, and as there was often such comminution of the bone that the two pins could not be applied at either end. The Stader apparatus might also have been used in selected cases if one had been available at that time.

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A section of rubber tire fastened with a few turns of plaster bandage to the foot of the leg cast, so that the tread remained exposed, proved the best walker for use on the ship's decks and ladders.

Upper extremity fractures.—Compound fractures of the arms were frequently extensively comminuted but in the lower arm often only one bone was involved. Both upper and lower arm fractures were immobilized in plaster by the same technic. Anesthesia was seldom necessary. The patient did not need to be transferred from the wheeled stretcher. The assistant held the fractured arm by the thumb in his one hand and the fingers in his other, maintaining the wrist and



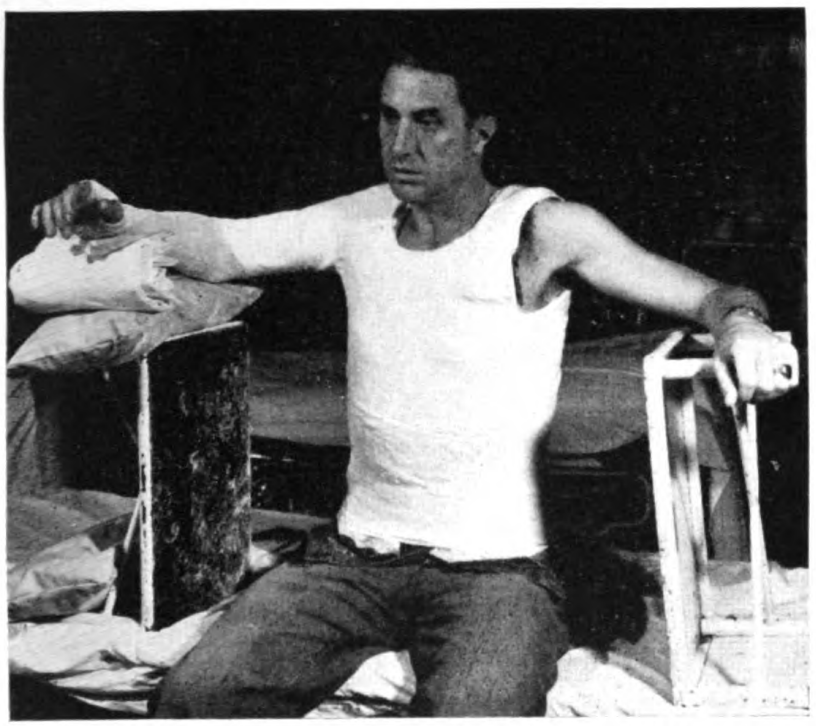
4. Position used for reduction and application of plaster cast in fractures of lower leg. Traction is applied by pressure of the operator's foot in loop connected to lower stirrup.

forearm in midposition, the elbow at a right angle and upper arm abducted from the side of the stretcher. The weight of the arm was usually sufficient countertraction. If additional traction was desired, a muslin sling was passed over the upper arm and under the assistant's foot. If telescoping of the bones of the forearm occurred, as observed under the fluoroscope when the traction was released, pins were introduced through the olecranon and distal radius to be incorporated in the cast which was applied from the base of the fingers to the axilla.

For fractures of the shaft of the humerus, the plaster cast was converted into a hanging cast. If there was extensive muscle damage or loss of bone substance, the hanging cast resulted in distraction of fracture fragments. It was then advisable to approximate the

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ragments and maintain their apposition by adding a body jacket. For this procedure the patient with the cast from fingers to axilla was placed in a sitting position with his legs over the side of the tretcher. A stool was placed under the casted forearm to give the esired amount of abduction. The alinement was maintained by an ssistant who supported the arm in the desired position while the body acket and arm cast were joined (fig. 5).



5. The completed body jacket used in fractures of the humerus with distraction and fractures about the shoulder joint requiring immobilization.

There were but two cases in which bone plates were used. Both were forearm fractures with extensive comminution of the radius and angulation of the ulna through the wound. The ulna in each case was the bone that was plated.

Open procedures on the compound fractures were done mainly about the elbow joint. Two cases with T fractures of the condyles of the humerus were transfixed with screws. One result was satisfactory but the apposition in the other was poor. Four cases had the fractured head of the radius removed. One of this group had fragments of the capitellum also removed, and another with a fracture of the upper one-third of the ulna had a Kirschner wire drilled through the olecranon into the medullary cavity of the ulnar shaft. The angulation of the fragments in the latter was not satisfactorily corrected. In none of the open procedures on compound fractures were the wounds

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closed. They were sprayed with sulfathiazole and overlaid with vaseline gauze.

Compound fractures of the head of the humerus, the glenoid, and the acromium were placed in 90° abduction and 90° external rotation and held by a plaster body jacket. When there was associated destruction or infection of the should joint, the body jacket was applied to hold the shoulder in 60° abduction, 10° flexion and 10° internal rotation. This was considered optimum position for ankylosis.

Fractures compounded into the knee joint.—Many compound fractures involved the knee joint (fig. 6). The joint was always aspirated and the material cultured. If the knee was obviously infected, even in the presence of an anterior wound communicating with the joint, a posterior capsulotomy was done to drain the joint. The knee was first irrigated with saline, then douched with sulfathiazole suspension. The capsule and soft tissues were held apart with vaseline gauze.

Depression of the tibial plateaus or condyles was corrected by a Böhler clamp and by forcing the knee into varus or valgus as required. Steinmann pins above and below the knee were necessary in two cases in which both tibial and femoral condyles were fractured. All fractures entering the knee joint were placed in a cast which included the pelvis.

Fractures of the os calcis.—Compound fractures of the os calcis were frequently so extensive that there was associated loss of bone substance. In two, impaction was broken up and molding with Böhler clamps attempted. This caused extensive hemorrhage. Neither case was much improved by the procedure. As the casts were not windowed and promptly became soft from drainage, they failed to hold the reduction. Subsequent cases were simply immobilized in plaster after the wound was treated.

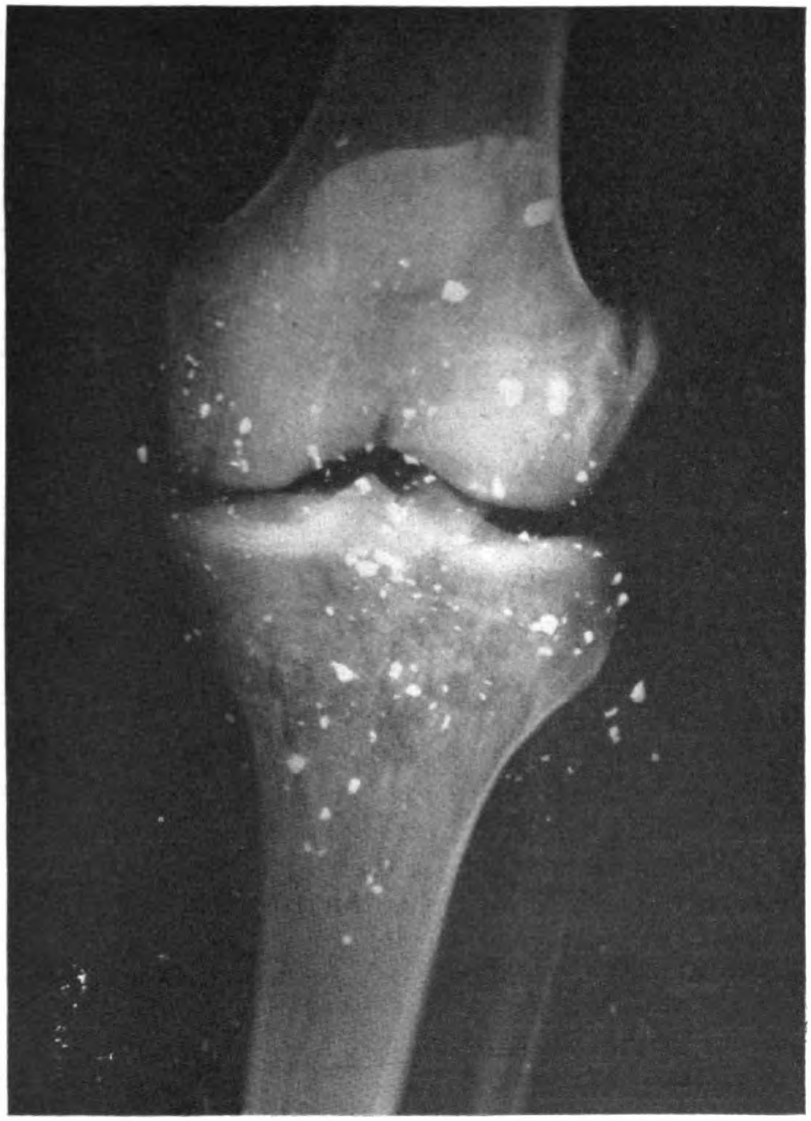
Fractures of metatarsals, metacarpals and phalanges.—Fractures of the metatarsals, metacarpals and phalanges were seldom single. The above-described wound technic was employed. No tendon suture was undertaken. An arm or leg cast was applied, a wire coat hanger was incorporated to project beyond the digits. Procaine was used to facilitate the introduction of a 22-gage needle through the pulp of the involved fingers or toes. Steel wire was pushed through the needle before it was withdrawn. The wire was then tied over a section of tongue blade, acting as a spreader, and rubber band traction applied to the distal loop of wire.

Chemotherapy and transfusions.—Sulfathiazole was continued by mouth for 1 week after injury or following reduction of the compound fracture. One gm. was given every 4 hours for the first 48 hours, 1 gm. 4 times daily for the second 48 hours and 1 gm. 3 times daily for the remaining days of the week.

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Transfusions of whole blood were given if the hemoglobin was below 60 percent or if the patient was in shock or in danger of shock.

Complications.—Shock occurred in two subjects with fractured femurs, during reduction under spinal anesthesia. They responded on the table to intravenous plasma and saline. Death was attributed to



6. Compound fractures of patella and condyles of femur and tibia with numerous metallic bodies and a pyogenic knee joint. This was treated with posterior drainage and immobilized in a hip spica.

shock in a third subject. He had a fracture of the lower end of the femur with a grossly infected knee joint. He was admitted in shock the third day after injury. He showed but temporary improvement to the measures instituted immediately to combat shock and died 20 hours later.

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Gas infection developed in only seven fracture cases while on this vessel. Numerous other patients had wounds which bubbled gas when their dressings were removed. The clostridium was not found on smear or cultured from their wound secretions. It was recognized that gas-forming bacteria and air in the dead spaces of these wounds were responsible. A score of fractured extremities had been amputated prior to arrival, because of gas infection. One of these developed gas in the stump and died. Another death from gas infection occurred in a compound fracture of a forearm in which, prior to admission on this ship, the wound had been debrided and sutured and the arm encased in a closed plaster cast. Two patients with lower leg fractures developed gas gangrene following reduction and immobilization. Both required lower thigh amputations. One of these was amputated using spinal anesthesia. The other was in extremis and the leg was refrigerated before amputation. The amputated extremities of both showed severance of the tibial arteries and occlusion of the popliteal artery as their respective circulatory difficulties. The three remaining cases in which the laboratory found the clostridium were treated with wide incisions and given from 160,000 to 200,000 units of antiserum in 48 hours. These were found to have had no subsequent complications and an uneventful convalescence when visited two weeks subsequently at the hospital to which they had been evacuated.

There were no cases of tetanus.

Secondary hemorrhage occurred in four cases. Three had a pulsating hematoma at the wound site upon admission. In each case a ligation was done. In two the femoral artery and vein had been perforated just proximal to the apex of Scarpa's triangle. Both the femoral artery and vein were ligated. The other two cases had the brachialis profunda and ulnar arteries ligated respectively. After these experiences all cases with pulsating hematomas were surgically explored and the severed vessels ligated.

Dressings.—Dressing changes were necessary in most large wounds, due to the profuse discharge of wound secretion. A cast became saturated and disintegrated within 48 hours unless provisions were made to remove the saturated dressings. The casts were windowed over discharging wounds to correspond with the outline of the underlying dressing. The dressings overlying the vaseline gauze were changed 4 times daily if they became saturated that frequently. The dressings were changed using instrument technic. The cut edges of the window in the cast were covered with sterile sponges in order not to contaminate the fresh gauze dressing by brushing against the cast edge. The wounds were sprayed with microcrystalline sulfathiazole and pressure bandages were applied over the dressings at the window sites.

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SUMMARY

1. Adaptations in surgical technic were necessary for the care of compound fractures on shipboard. All forms of balanced traction were supplanted by plaster immobilization.

2. Simplicity of technic and conservatism in management of cases were of primary importance.

3. Sedation without anesthesia was sufficient to permit care of a majority of upper extremity fractures.

4. Spinal anesthesia was used in almost all fractures of the lower extremities with displacement.

5. Maximal wound cleansing and minimal debridement was important.

6. Sulfathiazole locally and by mouth was used.

7. Early local use of sulfonamides gave a healthy appearing wound and a minimum of purulent discharge even in the presence of embedded foreign material.

8. Amputation for clostridium infections was not necessary except in the presence of circulatory impairment. Wide incisions however, exposing the deepest recesses of the wounds were imperative. The use of mixed antigas gangrene serum in large dosages intramuscularly was indicated in suspicious or proven cases of clostridium infection, in addition to generous use of sulfathiazole locally and by mouth.

9. Pulsating hematomas were evacuated and injured vessels ligated to avoid secondary hemorrhage.

10. Primary closure and early secondary closure of battle wounds was condemned.

11. Plaster bandages were best applied next to the skin without padding, except over bony prominences. There was no contraindication to the application of plaster of paris over a burned area or a decubitus ulcer that had been sprayed with sulfathiazole.

12. Fractured femurs were best immobilized in double hip spicas, except for fractures in the upper third of the diaphysis, which were reduced by well-leg traction.

13. Weight bearing in lower leg fractures was facilitated on shipboard by the use of a section of jeep tire on the foot of the cast.

14. The use of the hanging cast in compound fractures of the humerus proved ideal except in cases with extensive loss of bone or muscle, in which case plaster body jacket was necessary.

15. Comminution of bone fragments about an elbow joint demanded an open operation.

16. No operative wounds used to expose compound fractures were closed.

17. Knee joint infections were treated by posterior drainage and immobilized in a hip spica.

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18. Compound fractures of the calcaneus responded poorly to any measures other than immobilization.

19. Dressings through windowed casts were necessary in the presence of large wounds with profuse drainage.

20. Immediate wound care, early sulfonamide therapy and prompt immobilization is recommended for primary treatment of compound fractures. A Thomas splint with Steinmann pin traction was the best field dressing for fractures of the femur.

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SLOW UNION OF FRACTURES

During the past year or so there has been more than one reference to the impression held by many that fractures are taking longer to unite than formerly. If this were true it would, under present conditions, be a matter for serious concern, for fractures exert a drain upon manpower both in industry and in the Services.

A clear distinction must be drawn between the biological process of fracture healing and the modifications in this due to the methods of treatment used. There is little evidence that the biological conditions are any different now from those of 30 years ago.

The delaying factors came into force suddenly some years before the war and naturally there has been a tendency to interpret this as being the result of a sudden change in methods of treatment. Skeletal traction and unpadded plaster splints are suspect as also interrupted immobilization, traction, and distraction, infection, persistent angulation, too early weight-bearing, and loss of blood supply. In skilled hands operative reduction does not cause delay. The decision to use this method for unstable fractures should be made early rather than as a last resort.

It will surprise most people to read that of 3,000 fractures investigated, no less than 42 percent, or 1,276 fractures, suffered from mal-union, of which 896 had bad function (i. e., 30 percent of the total). Even in the anatomically good results (1,736 fractures, or 58 percent) there were 160 cases with bad function. Of 3,000 fractures therefore, the functional bad results numbered 1,056, or 35 percent.—Editorial. Slow union of fractures. Brit. M. J. 669–670, May 29, 1943.

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SIMPLE FRACTURES OF THE METACARPAL DIAPHYSIS

GEORGE V. WEBSTER
Lieutenant (MC) U. S. N. R.

The hand of man is the instrument of nearly every conceivable human activity, and as such its economic, social, and military importance are of the greatest concern. Its motor and sensory functions are miraculous combinations of strength, and delicate, graceful movements. Its architecture has inspired the writings and work of great students, and much is owed them for their contributions to knowledge in this field.

Poor results in care of injuries of the hand can be expected when well-established, sound anatomic and physiologic principles are disregarded. The most minute alteration of the structure of the hand can easily impair fine movements or sensation.

Anatomy and physiology.—The metacarpal bones have their anlage throughout the lower kingdoms. In the monkey and the higher apes, one sees the gradual specialization of these bones which separate the carpus and the digits. The metacarpal of the thumb (*1*) is the most interesting of the five, for it reflects the gradually increasing usefulness of the hand, and, with the advent of the opponens pollicis muscle in the hand of man, this metacarpal is increased in length, mobility, and usefulness. Its center of ossification appears at its base, whereas all the other metacarpals appear distally, at the metacarpal head. These centers appear in the ninth week of intrauterine life and thus the skeletal support for hand development is established very early.

The metacarpals of an adult hand are extremely complex structures. When the fist is closed they are compression members which can transmit a knuckle blow well up the arm through the tightened carpus which thus forms a rigid member. When the hand is open they support and amplify the differential movements of the digits so that as the hand is closed the fingers are first of unequal length; then at nearly complete closure they are equal, only to become unequal again as the tips are closed into the palm. The ease of grip, delicate touch and movement, and opposition of the thumb are thus facilitated and detailed observation of hand movements will demonstrate many interesting points in this connection.

The range of motion of the first metacarpal is the greatest of all, due to its interlocking double-saddle type of universal-joint articu-

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lation with the trapezium (multangulum majus). The long axis of the first metacarpal must pass accurately through the geometric center of the multangulum majus at the convergence of its axes of movement in both planes in order to realize a complete range of motion and fully utilize its leverage in producing strength of grip of the thumb. It is this displacement of the long axis of the bone (fig. 11) which so seriously disables the thumb when the metacarpal shaft is fractured.

The fifth metacarpal has the second greatest range of motion. The inclusion of an opponens digiti minimi, an abductor digiti minimi and a flexor brevis digiti minimi in the hypothenar muscle group indicates a rotatory movement as well as flexion-extension and adduction-abduction in its articulation with the unciform. This function is rudimentary and incomplete when compared with its pollex fellow, but it allows for greater compensation for postfracture deformity than is possible with the more rigidly fixed second, third, and fourth metacarpals. Thus it is not uncommon to tolerate a rather marked degree of angular or rotatory deformity of the fifth metacarpal without great disability. The disability is less when the fracture is in the distal third or subcapital region, and increases as the fracture site is more proximal.

The second, third, and fourth metacarpals are rather rigidly keyed together at their base so that little or no rotatory motion is possible and only movement in flexion-extension and adduction-abduction is present. Thus a rotatory deformity following fracture of these metacarpals is much more serious than with the first or fifth metacarpals. The relative rotation of the digits is related directly to the position of rotation of the metacarpals, and the long axes of the flexion arc of each finger follow a carefully integrated convergent pattern as the fingers are flexed from a completely extended and divergent position into lateral approximation with one another as they approach the palm. Rotatory deformity of a metacarpal following a malunited fracture causes an abnormal flexion arc of the finger, and in severe cases will even cause overlapping of the fingers as they are closed into the fist. This is more marked in fractures of the second, third, and fourth metacarpals than in the first and fifth for the reasons given, although certain compensatory corrections occur in the metacarpophalangeal and interphalangeal joints when this deformity is present.

The knuckles appear as the hand is flexed and, with their firm interosseous ligamentous attachments, they give rigid bulk and stability to the hand, maintain its width, and form the transverse hinge from which the fingers bend. In the clenched fist, they form the buttress of the striking surface. When a metacarpal shaft is fractured, there is shortening, dorsal angulation at the fracture site and concurrent

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olar displacement of the distal head (figs. 1, 3, 4, 7). This shortening nd volar displacement result in disappearance of the knuckle promi- ence, with several undesirable effects, chief of which is interference ith flexion of the digit (fig. 3). The grip is weakened, the strength f the transverse volar arch is diminished, and the striking power f the clenched fist is reduced. In addition to its functional impair- ent, the dropped knuckle and the dorsal "hump" are unsightly eformities and impair, however slightly, one's esthetic sense of being ormal.

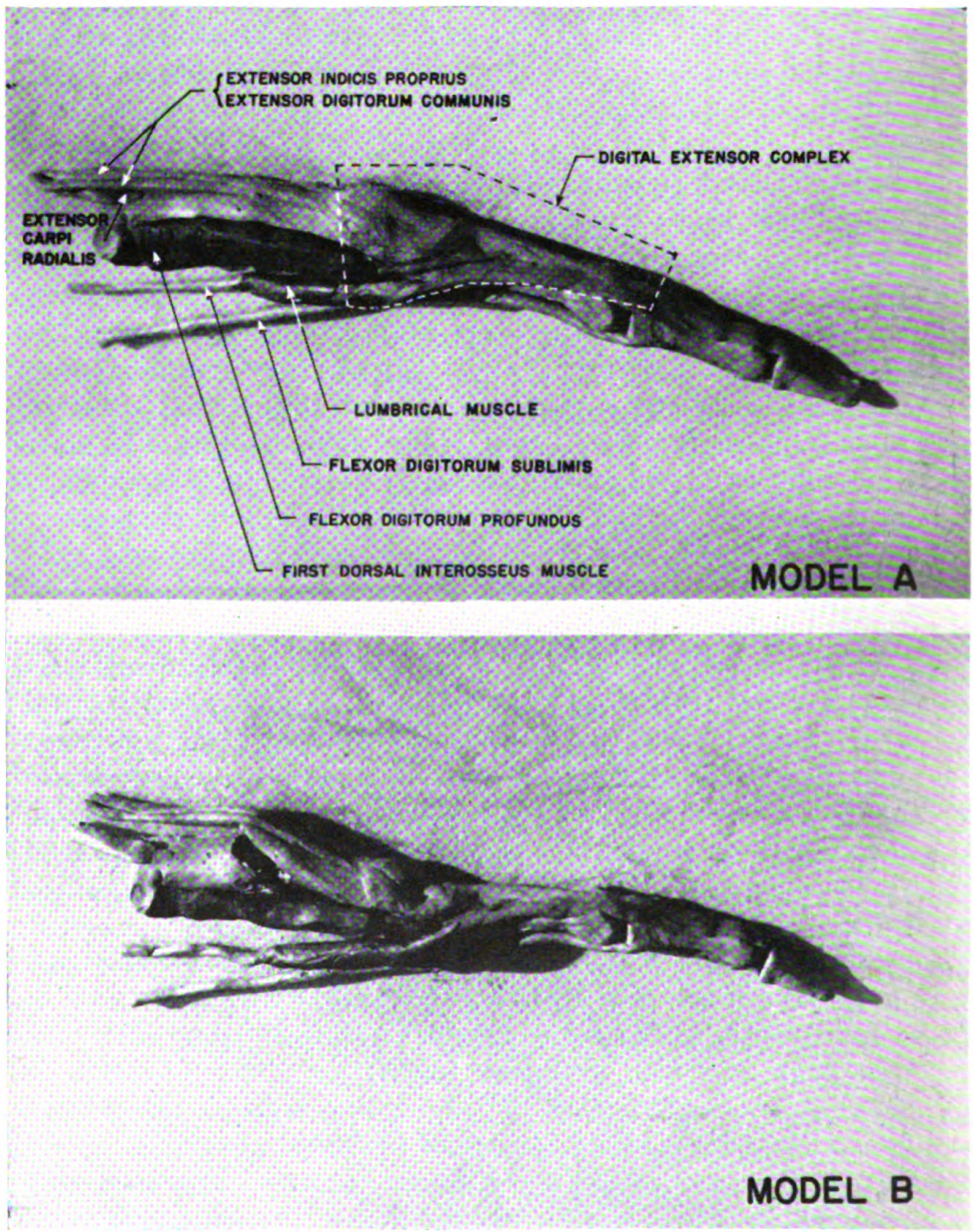
The second, third, fourth, and fifth metacarpals constitute a rhom- oid mass from which the first metacarpal, with its small muscles, rojects as an elongated pyramid. These masses are moved by all he digital flexors and extensors, and in particular by the purely arpal motor tendons (extensor carpi radialis longus; exterior carpi adialis brevis; extensor carpi ulnaris; flexor carpi radialis; flexor arpi ulnaris). The first metacarpal is the site of insertion of but one ong tendon (abductor pollicis longus), while the majority of its move- ents are effected by the small muscles of the thumb (flexor pollicis revis; opponens pollicis; adductor pollicis; abductor pollicis brevis) nd by its long flexor and extensors. The second to fifth metacarpals erve as origin for two sets of most important small muscles known s interossei because of their position between the metacarpal bones. Each set consists of four small muscles, known as palmar and dorsal nterossei. The former when contracted adduct the digits to the mid- ine of the third metacarpal, while the latter abduct the digits from he same line. These functions are important in consideration of ractures of the metacarpal shaft, and are closely related to the com- plicated digital extensor-flexor mechanism which is discussed below. The third metacarpal also serves as origin for the adductor pollicis, ut this has only slight bearing on fractures of the shaft.

Another group of small but important muscles whose function is ery much concerned with metacarpal fractures are the lumbricals. These delicate aids to fine finger movement have no bony attachment ut arise from the flexor digitorum profundus tendons of the index, iddle, ring, and little fingers, and, operating through the extensor omplex, are responsible for extension of the distal phalanges.

The digital extensor complex.—Of particular importance in the care f metacarpal fractures is an understanding of the movement of the ingers, and especially the structure and function of the aponeurotic endonous complex which constitutes the insertion of the lumbricals, nterossei, and extensor digitorum communis. Careful dissection of his aponeurosis shows an interlacing group of fibrous strands with hickened bands which are related to the stresses acting on it. This ighly specialized structure extends from just proximal to the meta-

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carpophalangeal joint, along the dorsal and dorsolateral aspects of the proximal phalanx, well over the proximal interphalangeal joint. Its insertion extends along the dorsum of the middle and terminal phalanges. It forms the dorsal capsular ligament of the metacarpo-



1. **MODEL A.**—Model of left index finger and second metacarpal, viewed from above, anteriorly, and the radial side. The palmar interosseus muscle is not visible from this angle and the adductor pollicis has been omitted for clarity.

MODEL B.—Pathologic position of structures when metacarpal shaft is fractured. Note the shortening, dorsal-angulation, overriding and palmar displacement of distal head of metacarpal. The lateral muscles are displaced dorsally, increasing the deformity.

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phalangeal and proximal interphalangeal joints and serves as the continuation and insertion of the extensor digitorum communis.

This extensor complex moves proximally or distally as a unit through a range of approximately 1 cm., but it also shows some differential movement in that the lateral slips can move the distal phalanges while the central slip remains immobile and fixes the position of the proximal phalanx. Lateral trabeculae connect the complex to the other extensors, and have attachments to the deep fascia which prevent slipping of the tendon from the knuckle crest. The interossei also act independently of the complex in abduction or adduction of the fingers through a firm insertion at their base.

The strongest motor power applied to the extensor complex is through the tendons of the extensor digitorum communis. These lie along the dorsal aspect of each metacarpal in their terminal thirds, though they converge near their base. Those destined for the middle, ring, and little fingers are connected by oblique tendinous bands which contribute unity to concerted finger action, yet allow for separate movement. The index finger has an additional extensor (the extensor indicis proprius).

The extensor tendons lie between two layers of deep fascia and are thus separated from the underlying metacarpals. There is no tendon sheath in this region, but the tendons glide on a slippery, delicate areolar tissue and thus move freely. The fascial layers and areolar tissue are not often broken through when simple fracture of the metacarpal shaft occurs, even though the angle of the fracture site extends sharply upward. There is rather a telescoping of the fragments, distal over proximal, which lifts the tendons upward as angulation occurs (fig. 1, model B). It is for this reason that adherence of the extensor tendons to the healing fracture site occurs so much less frequently than do the flexors to the phalanges when the latter are fractured. Contributory also is the greater power of the flexors which tend to stretch and overcome extensor adhesions when they do occur.

Extensor motion of the finger can best be studied in the living hand. Comparison of one's own left index finger with models A, B, and C [1] will prove helpful in understanding the range of motion that is possible to execute.

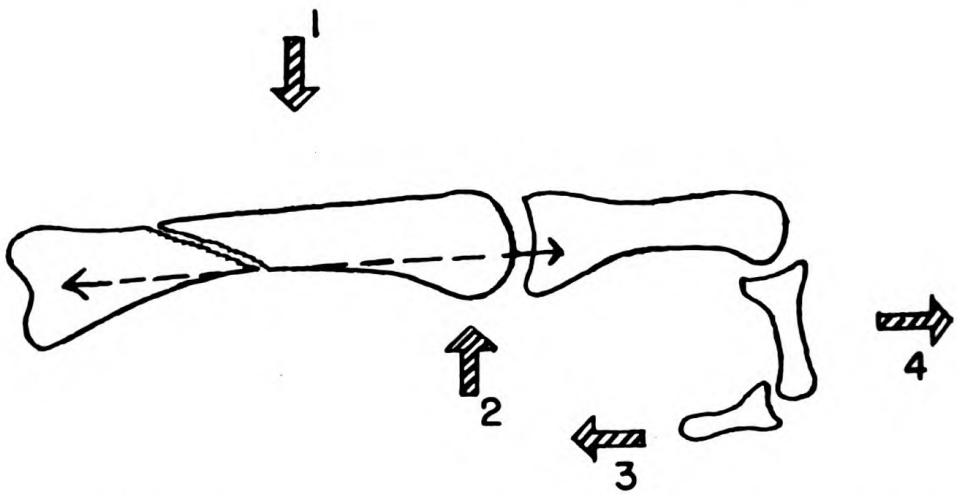
When the finger is flexed at the metacarpophalangeal joint and the interphalangeal joints are held stiffly, the extensor complex can be seen to move forward over the knuckles. If the phalanges are then completely flexed into the palm, the complex will move forward still

[1] The models have been carefully made in plasticine by the author from actual dissections of the left index finger and metacarpals in the cadaver. They are photographed from an oblique anterosuperior point of view to correspond to the left index finger of the reader as it is held to the left and below eye level.

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MODEL C



ARROWS INDICATE FORCES ACTING ON FRACTURED METACARPAL WHEN SPLINTED IN EQUILIBRIUM.

2. MODEL C.—Position of structures when fracture deformity is overcome. Fracture-line is still visible. Note the lateral splinting effect of the interosseus and lumbrical muscles under traction. Stress Diagram.—Dotted, double-headed arrow indicates pull of interosseus and lumbrical muscles under traction. Arrows indicate: (1) Downward force of dorsal padding, tending to prevent angulation. (2) Upward force of padded wire splint, elevating dropped distal head of metacarpal and also preventing angulation. (3 and 4) Traction forces supplied by skeletal pin through distal phalanx and counter-pressure by padded wire splint curved against the middle phalanx.

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farther, a range, altogether, of slightly more than 1 cm. Holding the proximal phalanx level with the metacarpal and flexing and extending the middle and terminal phalanges forms the position shown in model C. The complex can be seen to move forward a short distance as flexion occurs, but not more than 2 to 3 mm. At this point, it remains to fix the position of the proximal phalanx. With full extension, however, the complex moves nearly 1 cm. proximally.

The tendon of the lumbricalis can be observed and felt beneath the skin when in motion. When the terminal phalanges are flexed, this lateral slip of the complex can be visualized as sliding laterally over the proximal interphalangeal joint and in full flexion, it lies *below* the level of the long axis of the metacarpal and proximal phalanx, rather than *above*, as is the case in full extension of the finger. A glance at models B and C and the stress diagram will show the importance of this shift of position in treatment of metacarpal fractures.

When the terminal phalanges are flexed and the proximal phalanx is in line with the metacarpal, the resultant pull of the lateral components of the extensor complex is exactly in line with the metacarpal. It is necessary to apply traction in the direction of this long axis, with the finger flexed, to take advantage of these lateral muscular splints for the fractured metacarpal. Trueta (*3*) emphasizes the value of this treatment principle when he states, "The best means of obtaining good position is by the uniform pressure of muscles under traction, for these have a high splintage value."

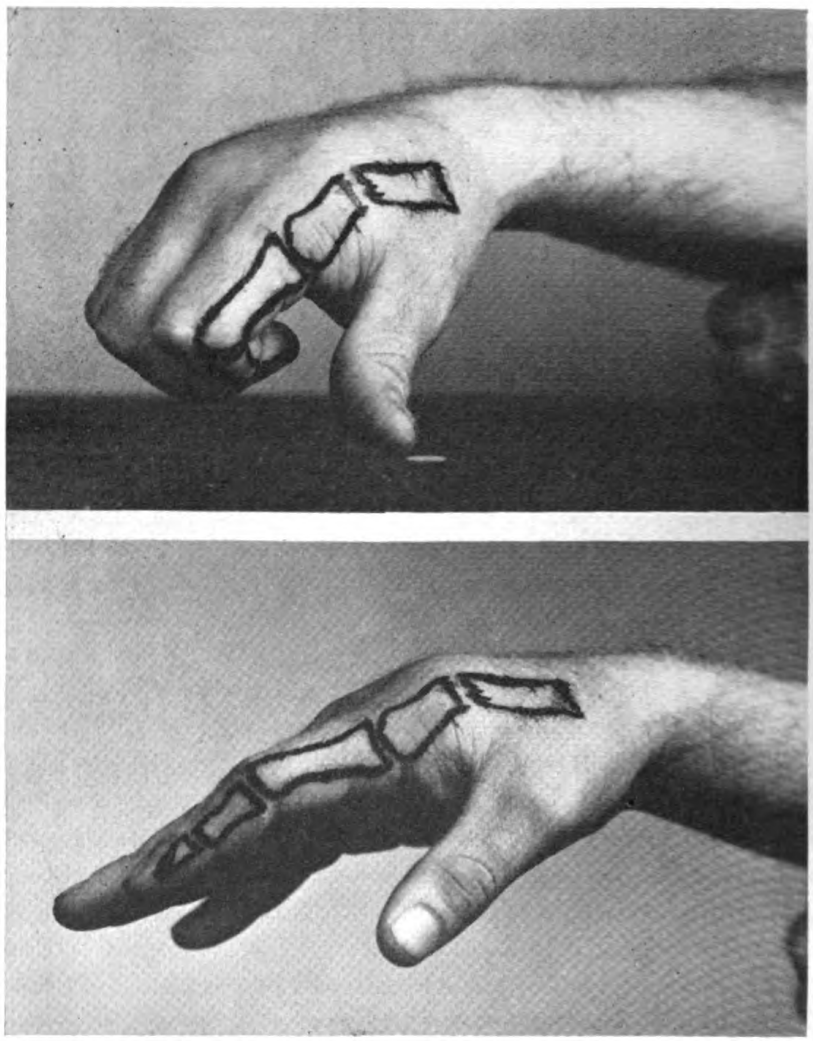
The digital flexor factor.—Flexor mechanisms of the fingers affect the fractured metacarpal only in so far as they tend to "bowstring" across the fracture angle. Flexion effort will tend to increase the fracture deformity. The origin of the lumbricals, of course, moves proximally as the finger is flexed, and this further improves the lateral position of the lumbricals described above and illustrated in model C.

One further point is important in connection with the flexors. If the left middle finger, for example, is fully extended and held in position with the other hand, and a tight fist is attempted by the other fingers, a sensation of discomfort will be noted in the left hand and forearm. This is due to the origin of the flexor digitorum profundus tendons from a common muscle, and illustrates one of many reasons why a straight splint should not be used in treatment of these fractures.

Incidence.—Simple fractured metacarpals are sustained most often through fist fights, and seen most frequently in the young male age group. Its occurrence in military service is consequently relatively high. In a 3-month period at a Naval mobile hospital, somewhat removed from the active combat zone, there were 15 cases of simple fracture of the metacarpals found on 154 roentgenographic examinations of the upper extremity. Three of the 15 cases had more than one

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metacarpal fractured, while there were 3 cases in which the first metacarpal, 4 in which the second, 3 in which the third, 3 in which the fourth, and 4 in which the fifth were involved, respectively. The series is admittedly very small, but compares roughly with the figures of Roberts (*4*) who reports that of 200 metacarpal fractures, "120 involved the fifth, 20 the fourth, 16 the third, and 44 the second."



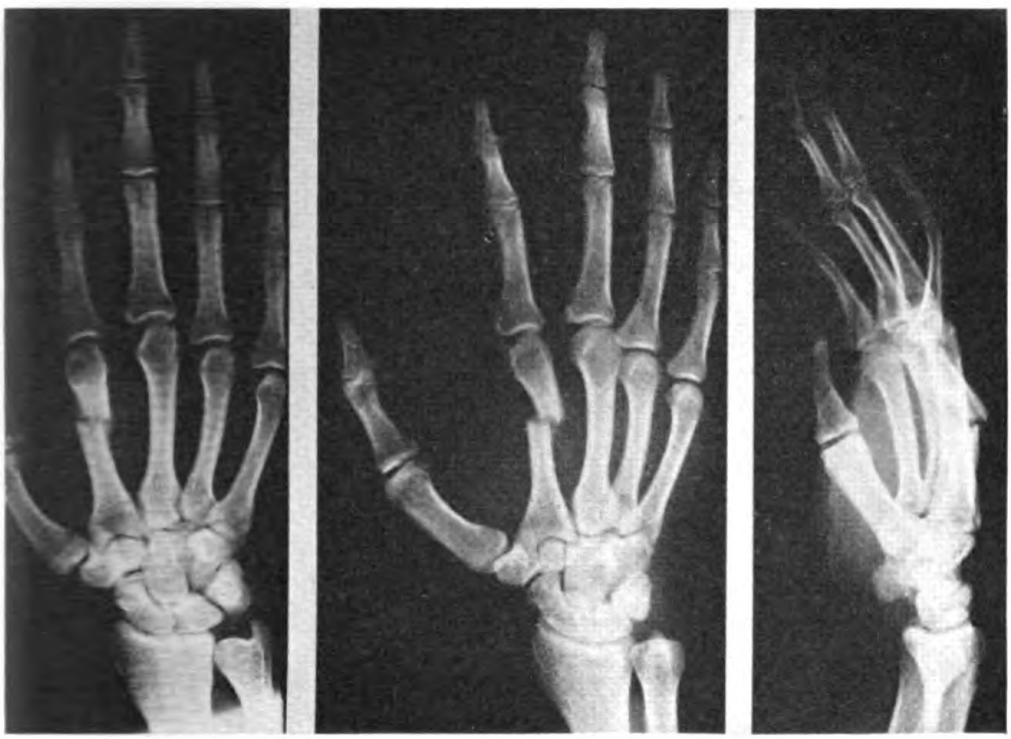
3. Marked deformity of malunited metacarpal after 4 weeks in unphysiologic traction on a straight board splint. Top view shows extreme limitation of flexion as patient tries to make a fist. Lower view shows typical dropped knuckle and dorsal angulation at the fracture site. (For graphic clarity, bony outlines have been sketched on the skin.) Clinical union was solid and osteotomy was required.

Diagnosis.—The fresh fracture is usually easily detected unless there is excessive edema and hematoma. In all such cases fracture should always be suspected and an x-ray will quickly clarify the diagnosis. The value of true lateral rather than oblique views is shown in figure 4.

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Linear fractures or fractures without displacement may be overlooked, but in the majority of cases, the characteristic deformity makes diagnosis easy.

Treatment.—For many years these fractures have been malsplinted on a straight board (figs. 3 and 4) or tongue-blade splint; or wrapped around a roll of bandage. The disadvantages of such procedures are numerous. In the first place, the fracture is not reduced. Traction is necessary to effect and maintain reduction and all the muscle stresses indicated in model B are present without opposition. Secondly, lateral motion is in no way prevented. Thirdly, the entire hand is immobilized either directly or indirectly, for even though a tongue blade is used, the other fingers cannot move freely. Thus the adjacent joints become stiffened, the normal stimuli to fracture healing are diminished and in older patients, some demineralization can occur. In addition, straight splints flatten the volar arch, are ill-fitting and reflect only the thoughtlessness of the surgeon and his lack of understanding of the human hand.



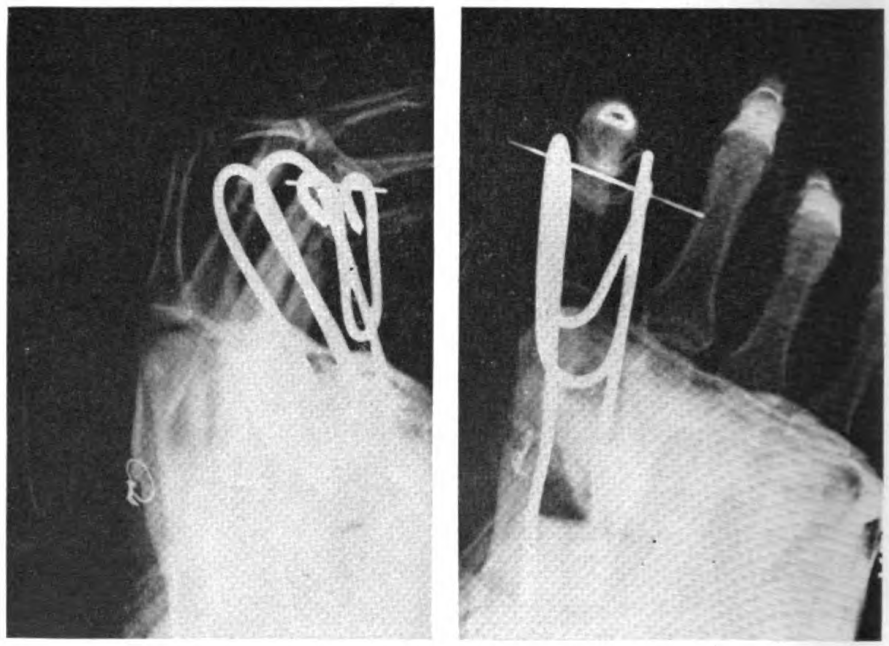
4. X-rays of case shown in figure 3. Fracture line is plainly evident and some callus formation is noted. Value of true lateral x-ray studies is emphasized by comparing the top view with the middle view which is an oblique. True deformity is not shown in oblique view. Bottom view is an anteroposterior which also minimizes true deformity.

The writings of Böhler (*5*) of Vienna are particularly pertinent regarding fractures of the hand. He advocated traction on the finger which was flexed over an extension splint of wire, while the fracture

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was held in the position of equilibrium. Counterpressure over the fracture site maintained excellent position.

In decrying the use of straight, flat splints with restriction of finger motion, Böhler gives as an illustrative case a man of 48 years who suffered a fracture of the right third metacarpal shaft which was splinted on a flat surface for 15 days after the accident before being resplinted. He states, "A year later, in spite of most intensive after-treatment, the fingers could not be closed to make a fist." These facts have been well known for many years, yet the consistent disregard of the proper principles emphasizes the need for more complete publication of their details. Many other writers have contributed more complicated means of treatment, but the fundamental truths em-



5. Same case as in figure 3.—X-rays following osteotomy. Note that deformity is not entirely overcome, though greatly improved. This is due to shortening which has occurred, in a 4-week period, in interosseus and lumbrical muscles. Such shortening is exceedingly difficult, if not impossible, to overcome, once malunion has occurred.

phasized by Böhler should guide our treatment at the present time.

In this connection it should be stated that without question, under proper circumstances, the open reduction and rigid internal fixation of the fracture with a smooth inert metal plate and dicortical machine-screw fixation will give the quickest and best return of function. To be successful, however, specialized skill, technic, and complete asepsis are necessary qualifications.

Operative technic.—The materials necessary for good operative treatment are universally available (fig. 12). The essentials are:

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Plaster of paris bandages, a little felt, some wire and a pair of pliers. In addition, some means for securing traction must be provided. Adhesive tape tends to loosen and is painful if it crosses the tip of the nail. Occasionally it constricts the finger. Traction on the fingernail itself is painful and inefficient and should never be used. The most secure and painless method is skeletal traction by a tiny Kirschner wire through the terminal phalanx (figs. 7 and 10). (Where this is not available, a steel safety pin will serve.) A standard Kirschner wire drill is used, using the finest wire. Care must be exercised to insert the wire through the shank of the distal phalanx avoiding the

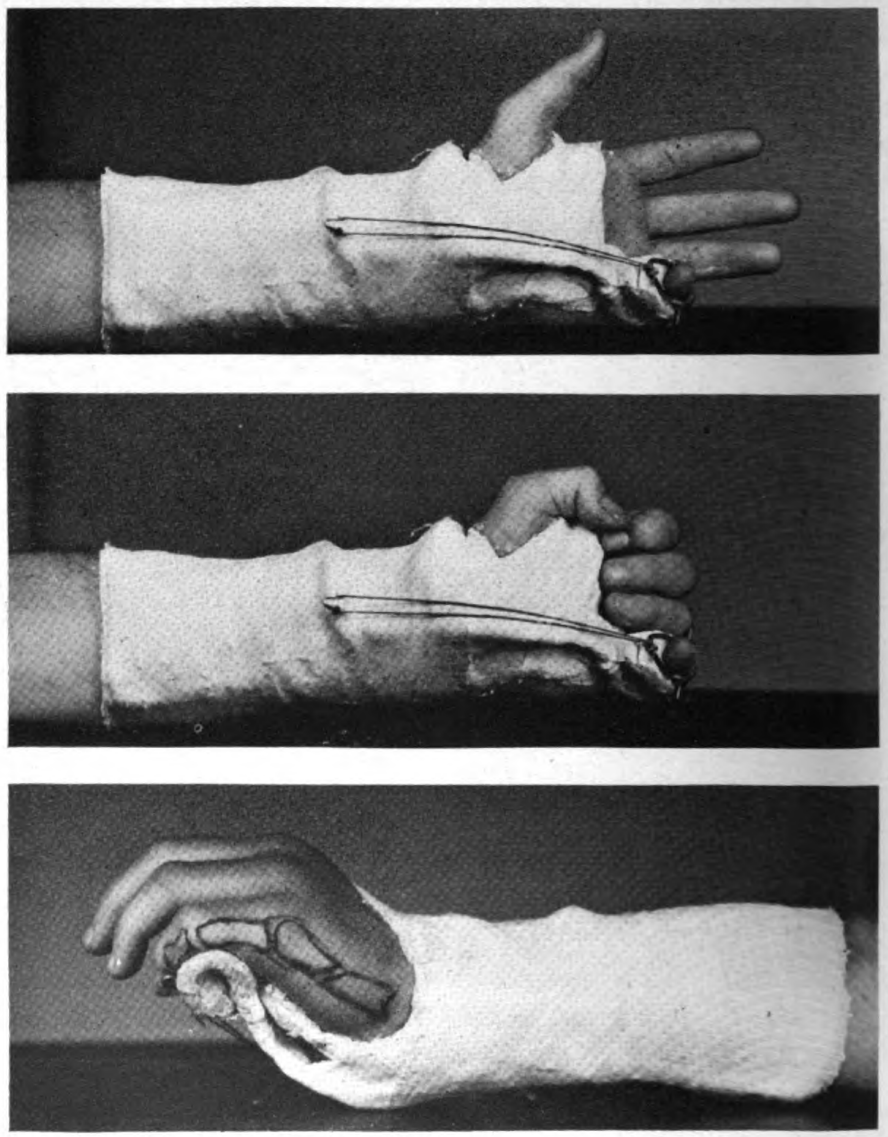


6. Spiral fracture of left fifth metacarpal, showing characteristic deformity. Right view is more oblique than desired, and does not portray full deformity.

most distal extension of the flexor tendon sheath and likewise avoiding passage through the pulp alone. The latter is sometimes recommended, but is painful and destructive and should be avoided. With the pliers a tiny wire stirrup (fig. 12) can be fashioned to secure traction on the Kirschner wire after it is cut to length. This can be sterilized by boiling so that its use near the entrance and exit wounds of the Kirschner wire will not contaminate them. In the actual care of the patient, prompt reduction is desirable but not absolutely necessary. If edema or ecchymosis is excessive, a few days of bed rest with elevation will aid rather than hinder repair.

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After x-ray studies, the forearm cast is applied and the wire finger-splint is incorporated and placed in its future position. The exposed hand is cleansed with soap and water, dried with ether and painted with tincture of iodine (one-half strength) to include the fracture site



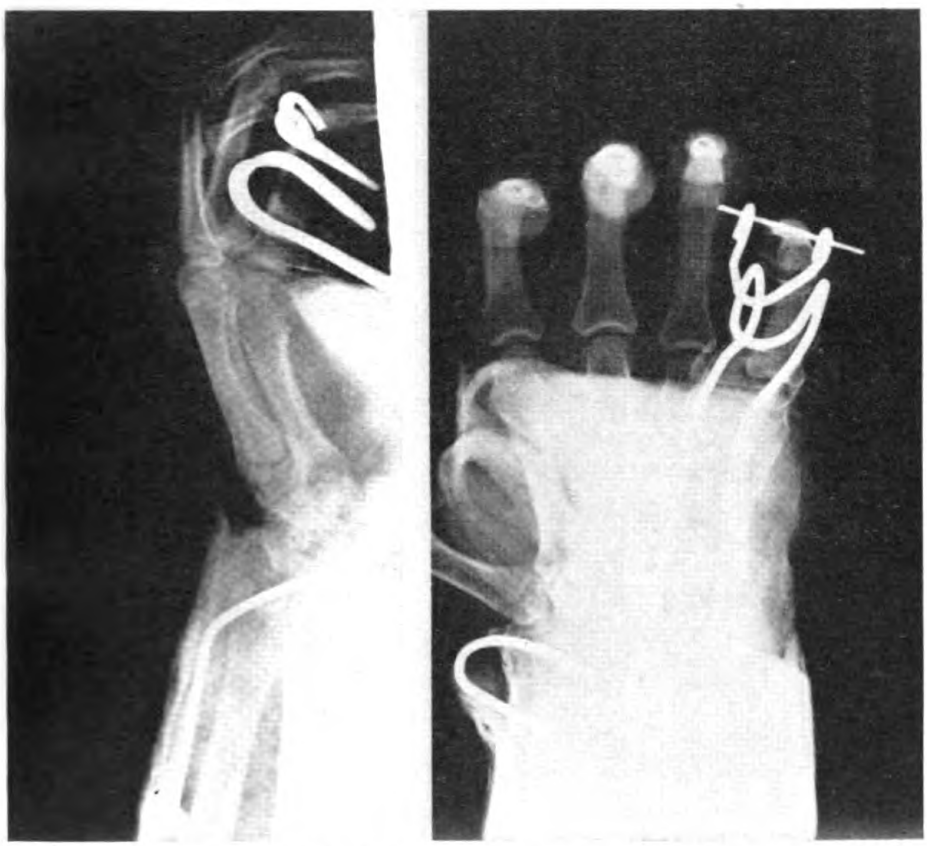
After reduction, fracture is splinted in equilibrium. Full motion of thumb and index, middle and ring fingers are encouraged from the start. Dorsal felt pad will be applied over fracture site and tightened as necessary. Note support of distal head of metacarpal by volar plaster splint. Bony outlines have been sketched on the skin in lateral view.

and the finger to be used for traction. Procaine (2 percent without epinephrine) is infiltrated into the fracture site and finger tip. After about 10 minutes full anesthesia is usually effective and the Kirschner wire and stirrup are placed in position first. The fracture is then

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reduced by manual traction and manipulation, the finger being brought down over the padded wire splint in traction and a firm, inelastic strand of twine is used to fix it to a small hooklet already fixed in the wrist portion of the wire splint (fig. 7). Care must be taken to avoid too great pressure on the splint, which may cause pressure necrosis. The traction should be in line with the normal convergence of the finger.

The following day a felt pad can be taped in place over the fracture site for the necessary counterpressure. This should be of sufficient thickness to exert localized pressure, and the tape must be made snug every few days for it tends to lose its pressure effect.



8. Same case as in figures 6 and 7.—Check-up x-rays following reduction. Note absolute flatness of dorsal aspect of metacarpal in the true lateral view.

Fractures of the first metacarpal require slightly different care (figs. 10 and 11). The plaster splint is bent to form an "outrigger" to which the traction cord can be fastened. The Kirschner wire is inserted in the terminal phalanx and fracture site infiltrated as before. The fracture is then reduced by traction and strong abduction on the thumb, and the stirrup secured to the "outrigger" by a strong cord. A felt pad is used for pressure over the fracture site as with the other metacarpals.

A few cases of fracture of the second, third, fourth, and fifth metacarpals near the base, partial fracture of the distal head, or fractures

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of the shaft without displacement, can be splinted safely with volar and dorsal short splints of lightly padded plaster. The volar splint should extend from a hand's breadth proximal to the wrist to the proximal interphalangeal flexion crease, leaving the middle and terminal phalanges and the thumb free for active motion. The dorsal splint begins at the same level and extends only to the distal head of the metacarpals. Such splints should be molded accurately to normal hand contours and slight pressure made over the fracture site. They are bandaged in place and rebandaged as necessary. These cases must

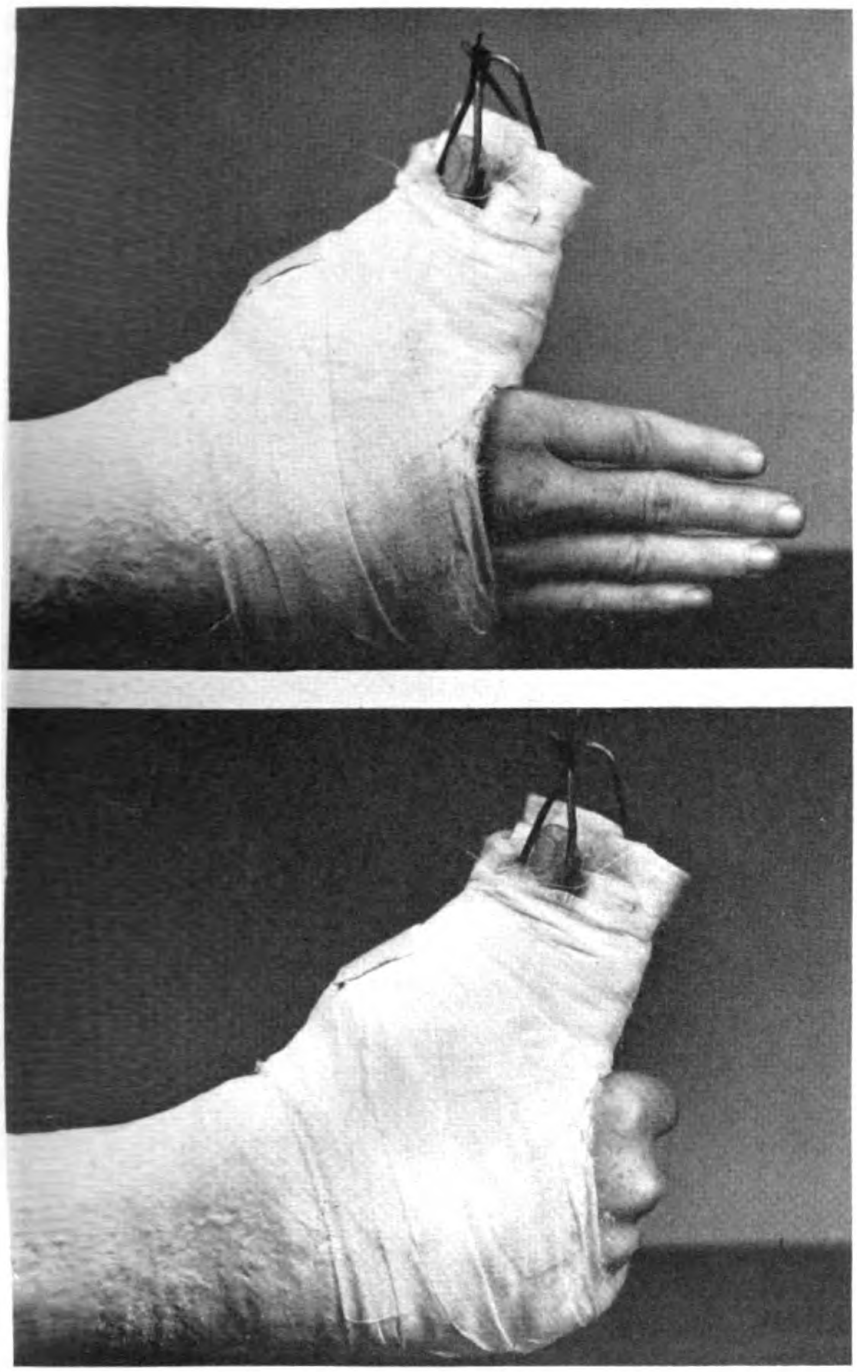


9. Same case as in figure 8.—Check-up x-ray at 4 weeks. The splint has been removed and the fracture is clinically healed. The fracture lines are still plainly visible and do not fully calcify for 10 to 12 weeks. The true lateral view shows that position has been maintained.

be carefully selected, for many fractures of the shaft without initial displacement can buckle later under the muscle stresses (model B).

After-treatment.—The cast is allowed to remain in position 4 weeks. A single check-up x-ray plate (fig. 8) or fluoroscopy should be made after reduction to insure good position. Motion of all but the affected finger is encouraged and all possible use should be made of the hand and arm (figs. 7 and 10). Most of these men are fit for light duty after 1 or 2 days. At 2 weeks, the Kirschner wire and stirrup are removed and all possible motion of the affected finger is encouraged. At 4

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10. Fracture of first metacarpal splinted in abduction, with pad for counter-pressure bandaged firmly in place. The skeletal traction on the terminal phalanx is secured by a stirrup to a rigid wire "outrigger," avoiding more cumbersome devices. Note ease with which fist is closed, facilitating active exercise.

weeks, the cast is removed and an x-ray made (fig. 9). The bone is usually clinically healed at this time, but full calcification does not occur for 10 to 12 weeks. Hence the patient should be cautioned to avoid excessive trauma during this additional period.

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Initial complications such as "human-bite" knuckle injuries, tendon lacerations or other compound injuries deserve even more elaborate consideration, but their care lies outside the scope of this paper.



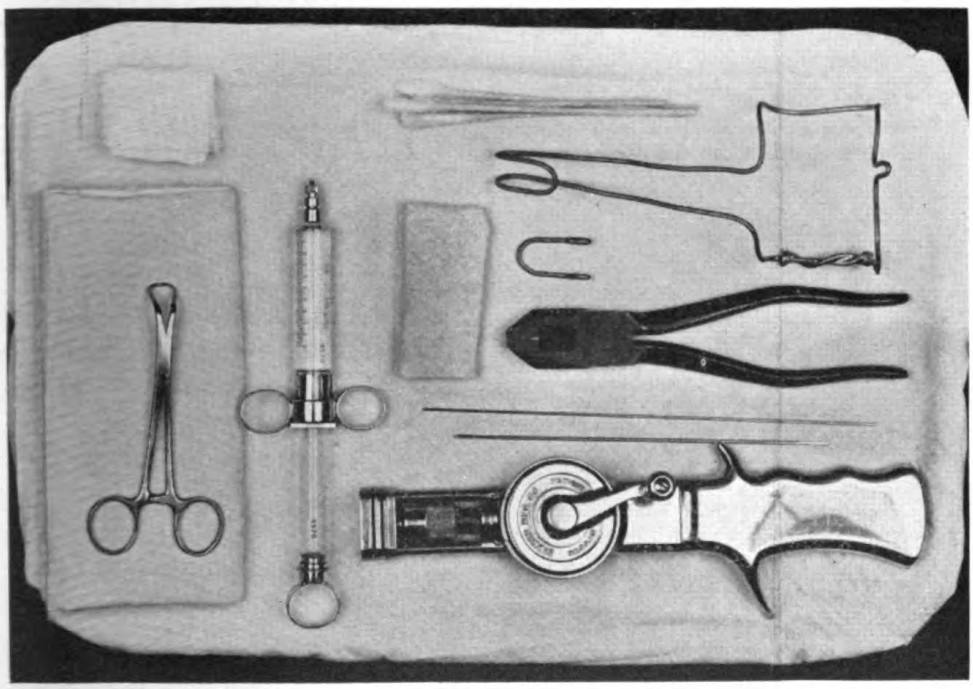
11. Same case as in figure 10.—Top views show x-ray appearance at time of injury. The long axis of the distal fragment passes completely outside the normal center of articulatory arc in the trapezium (multangulum majus). Lower views show x-ray appearance after 5 weeks of splinting in equilibrium. The fracture was clinically healed at this time, though complete calcification of the fracture site will take several weeks longer.

Malunion.—When the after-care of the fracture has been poor, and traction and pressure have been allowed to relax, or when poor initial treatment has been given, malunion may occur. This produces the crippling deformity illustrated in figures 2 and 4. The fist cannot be closed properly and the hand is weak and deformed. The inter-

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ossei have undergone contraction and even following osteotomy, complete correction is usually impossible (fig. 5).

Treatment consists of osteotomy at the fracture site. A bit of good carpentry may be required to key the proximal and distal fragments into an accurate fit with one another, using a chisel and possibly metacarpal saw. The fragments usually must be secured with wire if plating is not used (fig. 5). Where rotatory deformity is present, exceptional care must be used to correct the rotation at operation. A word of caution should be added regarding the identification and preservation of the dorsal sensory nerves of the hand, for they may be divided unwittingly at operation.



12. Simple tray showing all necessary instruments and materials for proper care of fracture of metacarpal shaft, except plaster of paris bandages. Applicators for iodine, one towel and one towel clip produce a sterile field. The stirrup and splint are easily made of wire and are sterilized, together with the pliers, as adjustments near the Kirschner wire may be necessary. The Kirschner drill is shown, but in its absence a sterile steel safety pin can be used for traction. Novocain (2 percent without epinephrine) is used for fracture site and finger tip. The felt is used for counterpressure over the fracture site and need not necessarily be sterilized.

SUMMARY

The importance of good care for metacarpal fractures, especially in war, is stressed. Physiologic and anatomic principles, which affect the metacarpal when it is fractured, are discussed in detail. Incidence is relatively high. Treatment measures are outlined, both for fresh

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fractures and malunion. It is hoped that by attention to details of good treatment, disability from this common fracture can be reduced. *Splinting on a straight board, tongue-blade splint, or about a roll of bandage is to be avoided if deformities are to be prevented.*

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BLOOD PRESSURE IN LOWER EXTREMITY

The auscultatory (indirect) method of estimating arterial blood pressure in the arms is widely employed. Normal standards, based on figures obtained with this technique in large numbers of subjects, are already well established.

Employing the standard auscultatory method for measuring blood pressure, average values for the lower extremities of 500 normal male subjects were obtained.

The average arterial pressure in the thigh, with the subject in the horizontal position, is 154.8 mm. Hg, systolic, and 91.9 mm., diastolic, and, in the arm, 118.3 mm., and 70.6 mm., respectively.

The weight of the subject apparently exerts a modifying influence upon the blood pressure, for higher pressures are present in the heavier subjects. This observation is in agreement with the data accumulated by various investigators concerning the relationship of obesity to the brachial blood pressure. This suggests that the soft tissue mass in a limb may, for technical reasons, affect the estimation of the blood pressure. From this study it is seen that a direct relationship exists between the circumference of the upper and lower limbs and the blood pressures as measured in them by the auscultatory method.—Wendkos, M. H., and Rossman, P. L.: The normal blood pressure in the lower extremity. Am. Heart J. **26:** 623–630, November 1943.

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FRACTURE OF THE CONDYLE OF THE MANDIBLE

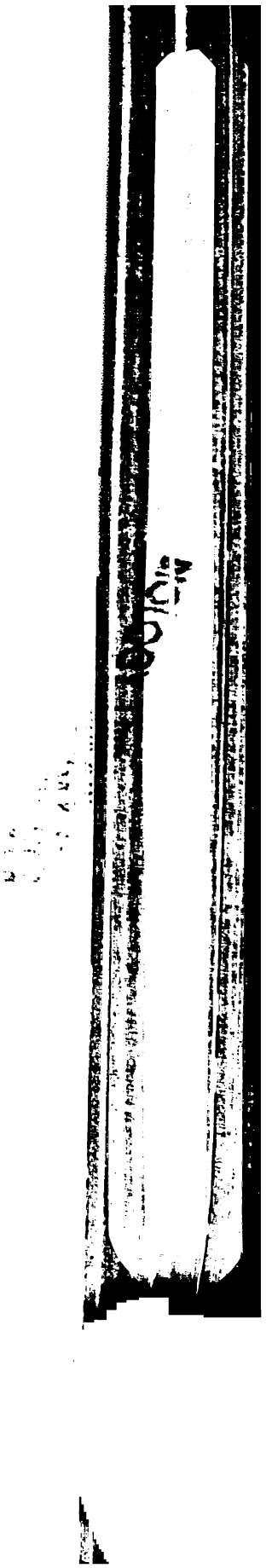
JOSEPH A. DOHERTY
Lieutenant Commander (DC) U. S. N. R.

Traumatic lesions involving the condylar process of the mandible occur in civil life usually from the impact of a strong force sustained in the region of the symphysis. In modern warfare shrapnel wounds constitute an important etiologic factor. Irrespective of the cause, the principles underlying treatment are similar. The frequency of this type of injury is suggested from a series of one hundred fractures of the mandible analyzed at Massachusetts General Hospital (*1*), 7 percent of which involved the neck of the condyle.

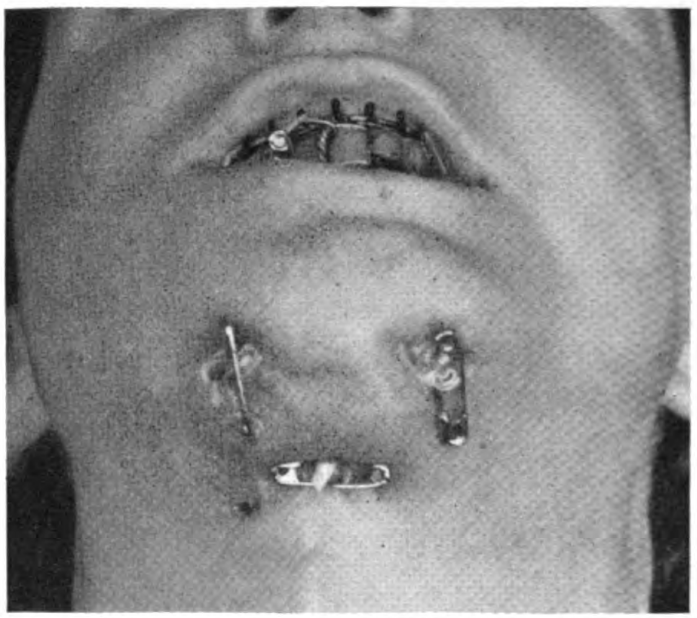
The symptoms which generally accompany mandibular fractures are also observed in injuries of the condyle. There is tenderness, swelling, difficulty in swallowing, and loss of function. Asymmetry of the facial contour is proportionate to the degree of displacement of the fractured parts. Deviation of the chin toward the side of the injury is a constant symptom with shortening of the ramus on the same side. Signs of crepitus may be elicited by palpation of the soft tissues anterior to the external auditory meatus. The tendency for the head of the condyle to be drawn forward and inward by the external pterygoid muscle may result in a slight depression in this area. Retraction of the chin from the median line, however, may also be a symptom of dislocation of the temporomandibular joint.

In the diagnosis of this type of fracture clinical findings should always be supplemented by a roentgenographic survey. Unfortunately fractures of the condyle do not lend themselves well to clearcut x-ray pictures. When a single complete survey is made the existence of fractures of the condyle may readily be established, but it is impossible to determine accurately the direction and location of the fracture line. More satisfactory evidence may be obtained by the roentgenographic technic employed in mastoid cases or by passing the rays through the opposite sigmoid notch.

Adequate treatment of this fracture is predicated upon a coordinated knowledge of anatomy, physiology, orthopedics, and general surgery. Failure to apply the principles of these specialties can only result in a facial deformity. There are two divergent schools of thought in the management of this type of injury. Advocates of the open reduction method have endeavored to restore the condylar head to its former location in the glenoid cavity. This is extremely difficult



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1. Fractures of both condyles of the mandible with associated fracture and osteomyelitis of the symphysis.



2. This presents a fracture of the neck of condyle with marked lateral displacement of mandible. Reduction and immobilization by use of Gilmer arch and elastic traction.

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of accomplishment. There is, moreover, the possibility that the seventh nerve might be traumatised, with resultant facial paralysis.

Restoration of the normal profile, regardless of the position of the condyle, has generally been followed by good functional and cosmetic results. Where teeth are present in both jaws, the use of intra-oral wiring, preferably by the Gilmer method, is very satisfactory. It cannot be stated too emphatically that treatment by maintenance of mobility of the joint is impractical. The use of a head bandage tends to increase the degree of injury. Elastic traction has long been fundamental in the treatment of fractures of the jaws, especially when there is marked displacement. In the management of condylar fractures this method serves a definite and important role. Figures 1 and 2 illustrate typical cases.

Among the early complications of condylar fractures are hemorrhage and respiratory embarrassment. The former is minimized by early reduction; the importance of the latter depends upon the degree of obstruction. When there are associated fractures in the body of the mandible, cellulitis and osteomyelitis are potential complications. The maintenance of adequate and continuous drainage, regardless of whether soft or hard tissues are involved, will promote early healing. The necessity for removal of sequestra is obvious.

SUMMARY

Fractures of the neck of the condyle are characterized by facial asymmetry accompanied by the usual symptoms associated with fractures in general. Diagnosis is based upon adequate clinical and roentgenographic examinations. Satisfactory end results may be obtained by methods which tend toward immobility of the parts. Complicating cellulitis and osteomyelitis are best managed by adequate incision and drainage of the infected area.

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EXTRA-ORAL FACIAL PROSTHESIS

THE ELASTIC VINYL PLASTIC METHOD

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This preliminary report introduces a new method of facial prosthesis utilizing vinyl resin with certain plasticising agents added to produce an elastic plastic. The method described here is being developed in an effort to furnish interval prosthesis for facial casualties undergoing a series of reconstructive operations, to furnish permanent prosthesis when reconstruction of the deformed area is not recommended, and to complement the appearance after maximum functional and cosmetic improvement have been attained surgically. The resulting value to the morale of the patient obviously requires no discussion.

Imperceptibility of the appliance as such is the goal which all methods of prosthesis strive to attain. The successful achievement of this end demands color and texture resembling the surrounding skin area, a consistency approximating normal tissue, and an indiscernible blending edge. The difficult problem of matching individual skin tones is facilitated in this new work by the fact that the vinylite can easily be colored by ordinary pigment in almost any form—grease paints, oil paints, and aqueous or alcoholic solutions—without producing either deterioration of the appliance, or modification of the color of the pigment. The basic color is added when the material is being mixed, and the more subtle skin tones are added later to the completed part. Any desired skin texture may be created when the prosthesis is being modeled in clay. Obviously, the texture should be harmonious with the surrounding tissue. The usual problem of blending the prosthesis with the adjacent area is made easier in this method, because the edges, being tapered to tissue-paper thinness, have a translucency which enables the underlying skin tones to penetrate. To the touch, the appliance has a consistency resembling slightly tensed muscle, and is elastic enough to permit moderate movement with changes of expression. These four factors—color, texture, consis-

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tency, and an imperceptible blending edge—combine to create a life-like prosthetic replacement of the deformed area.

The nontoxic quality of vinylite has enabled our patients to wear facial appliances continuously for a period of 17 days without evidence of skin irritation. Presman [1] reports on the use of a vinyl resin formula which produces a thick, impermeable film found to be nontoxic to the sides of the exteriorized bowel. Ethyl alcohol, brushed on the underside of the appliance, produces a thin adhesive layer of the softened material which adheres firmly to the skin. This method of application, in avoiding the use of glues and gums, eliminates the possibility of skin irritation from foreign material.

Vinylite shows no change when exposed to the variations in temperature or humidity encountered in any part of this country at any time of the year. It is impervious to oil, grease, and moisture, and thus suffers no deterioration when it encounters these substances. This property permits the use of oil and grease paints in coloring, and allows the patient to wash the appliance without fear of destroying it.

Other advantages of this method, further discussed under technic, are the ease and economy of replacement, and the fact that neither highly skilled technicians nor elaborate equipment are necessary to make the appliances after the original molds have been created.

TECHNIC

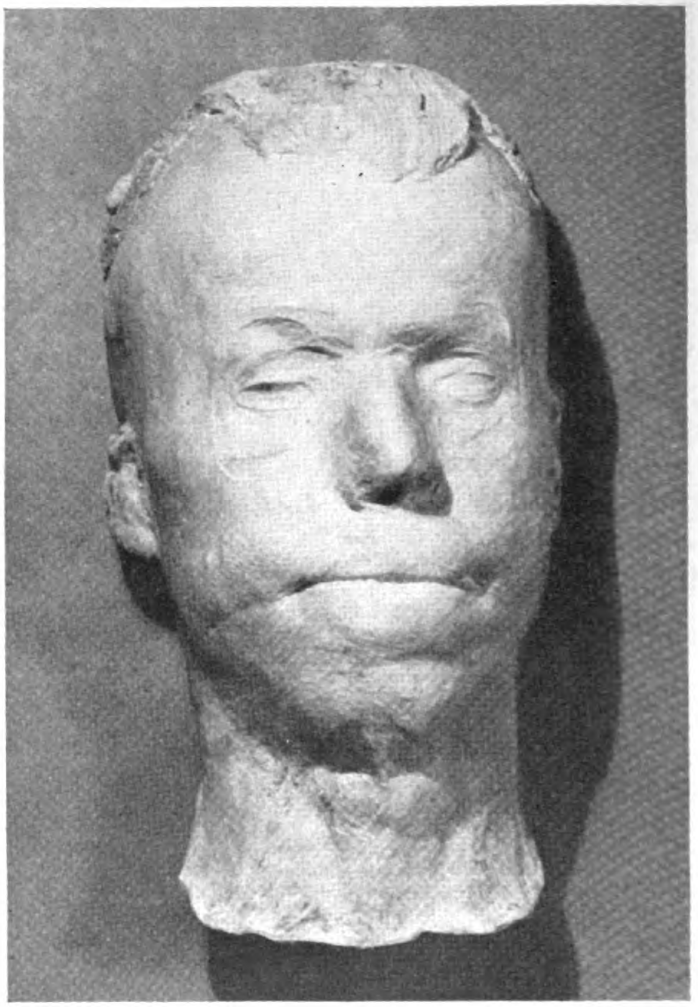
It is not within the scope of this paper to discuss the technic of handling plaster molds; it is assumed that anyone attempting the creation of a prosthetic appliance will be thoroughly familiar with the routine methods involved.

A plaster cast (fig. 1) is made of the patient's face. We prefer negacoll for the original impression, but any material which will reproduce the skin texture accurately is satisfactory. From this cast a regional mold (fig. 2) is made of the deformed area. Since this mold will constitute the male mold, and will be used for pressing the appliance, it must be strongly made of hydrocall, and reinforced with fiber. On this regional mold the deformed area is built up to a normal contour with modeling clay on which the desired texture is created (fig. 3). Directly over this, a female mold of reinforced hydrocall is cast. When the two molds are separated, and the modeling clay is removed, we have a male mold and a female mold which, when placed together, have a cavity representing the area to be occupied by the prosthesis. A fresh mixture of the vinylite is pressed into the female mold; the male mold is applied, and the two are pressed together for 30 minutes. The molds are separated, and the fresh appliance is

[1] Presman, D.: New method of skin protection for iliostomies and colostomies. Surgery 13: 322–323, February 1943.

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left on the male mold for several hours to be exposed to the curing action of the air. Replacement is made by simply pressing a fresh mixture of the material between the two molds, and continuing as described above.



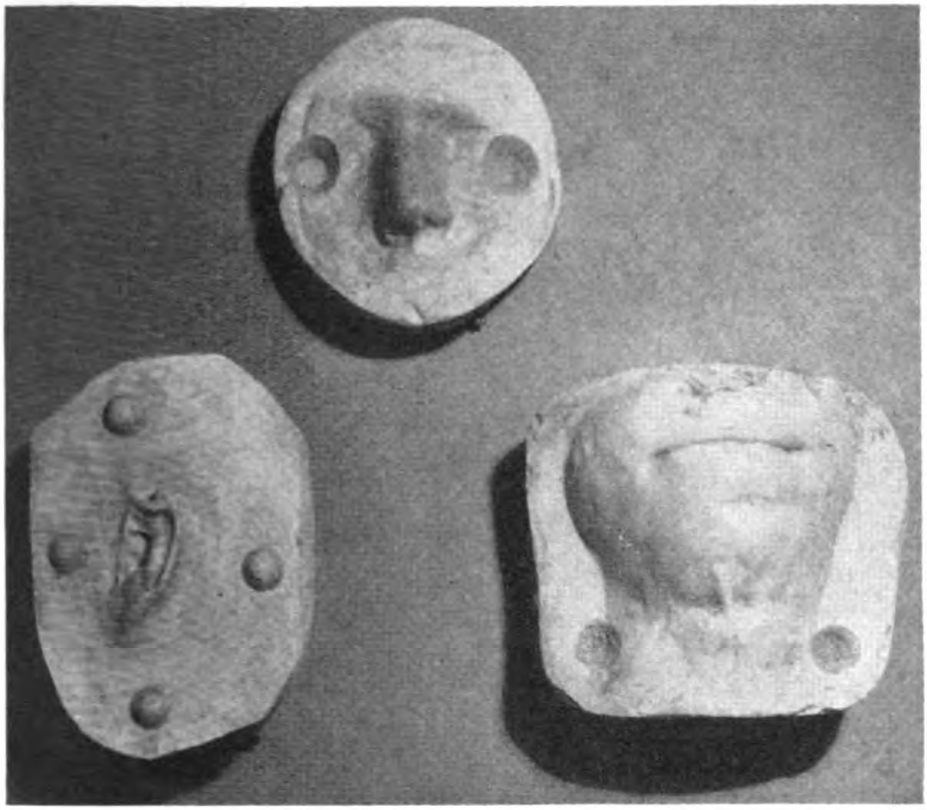
1. Facial mask of patient's entire face. Original negacoll impression reproduced in plaster. It is important that the skin texture be reproduced so that it may be modeled into the prosthetic appliance.

APPLICATION

The under surface of the prosthesis exactly fits the disfigured area, while the external aspect presents a normal anatomic and cosmetic contour. Firm adhesion is accomplished by brushing the under side with ethyl alcohol, and applying the part accurately to the deformity. Any desired adjustment in color tone is made at this time.

No exact formulae of the material used are given in this preliminary report, because new and improved formulae, having greater versatility and stability, are being developed.

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2. Regional molds of deformed areas. These molds are reproduced from the master mold (fig. 1). As they will become the male molds for pressing the prostheses, they are strongly made of hydrocall, reinforced with fiber.



3. Regional mold of nose (fig. 2) built up to normal contour with modeling clay. The desired skin texture is applied at this stage.

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CASE REPORT

A 26-year-old man was severely burned about the face and hands when an airplane he was piloting caught fire. First aid and early care were rendered. The patient was later admitted to the hospital for reconstructive surgery. The condition of the patient's face on the original admission date is shown in figure 4. At that time the entire face was a mass of thin scar tissue with numerous areas of ulceration. There was deformity of both ears, the nose, the mouth, eyelids, and loss of the eyebrows and temporal hair. Both eyes showed marked conjunctivitis, with ulcerations of the left cornea. The patient was unable to open



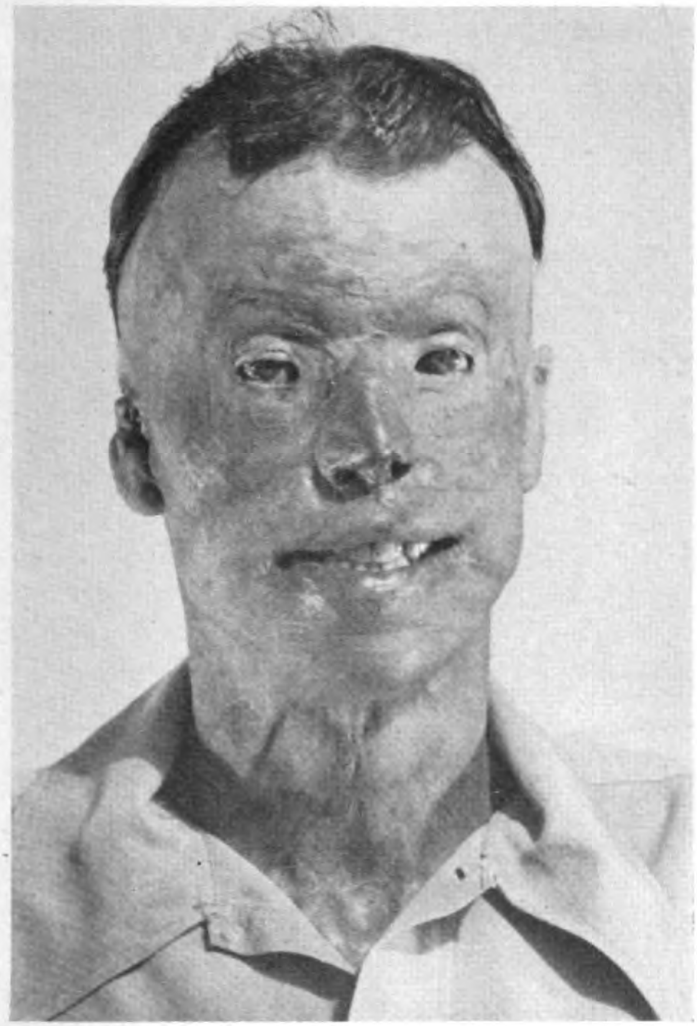
4. Condition of patient's face 3 months after the original burn. The entire face is a mass of thin scar tissue with numerous areas of ulceration.

his mouth sufficiently to chew or to cleanse his teeth. He underwent a series of reconstructive operations. These operations restored the function of the nose, the eyelids, the mouth, the ears, and the hands, and brought the patient cosmetically to the condition shown in figure 5. There was decreased vision of the left eye due to corneal scarring. Surgical repair was interrupted by the patient's employment as a radio operator in the merchant marine.

The patient suffers no embarrassment in the restricted environment of a ship at sea, but he is sensitive about his cosmetic deformities when ashore. An

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attempt was made to furnish him with an interval prosthesis pending further surgery. The prosthesis offered consisted of appliances for both ears, the nose, and the chin, and hairlace pieces for the temporal regions and eyebrows. The above was supplemented by make-up to color cheek scars. The final results are shown in figure 6.



5. Condition after reconstructive surgery and before vinylite prosthesis.

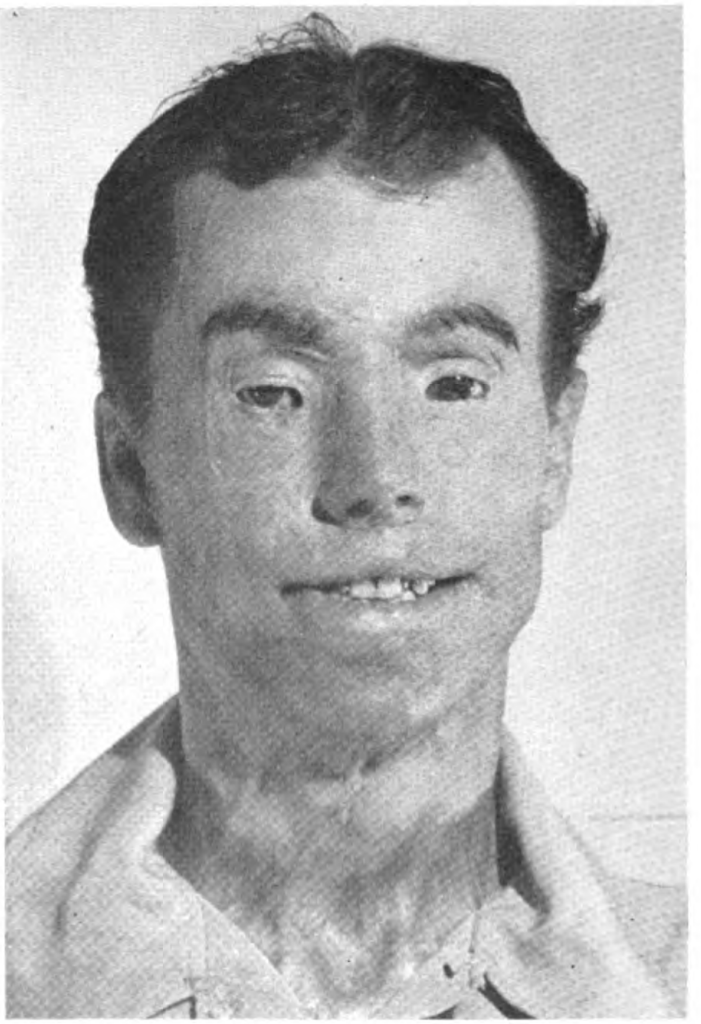
SUMMARY

This preliminary report presents a new method of extra-oral facial prosthesis using an elastic vinyl plastic material:

1. Normal skin color is approximated.
2. A lifelike texture and consistency are achieved.

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3. No blending edge is visible.
4. The material is nontoxic.
5. Firm adhesion is obtained without the use of gum or glue.
6. The prosthesis is unaffected by ordinary changes in temperatu and humidity, and is impervious to oils, greases, and moisture.
7. Appliances may be replaced with ease and economy.



6. Final result.

The authors wish to acknowledge their indebtedness to Mr. Jack Dawn, director of make-up, and to the personnel of the laboratory of Metro-Goldwyn-Mayer Studios, Culver City, California, for their assistance in the handling of this case.

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EYE INJURIES

WITH REMARKS ON PLASTIC SURGERY

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Perforating wounds of the globe are always serious. They frequently destroy the injured eye, requiring enucleation, and also potentially give rise to sympathetic ophthalmia with consequent total loss of sight.

Anterior perforations, involving the cornea only, without entrance of a foreign body, often heal well. Occasionally the iris prolapses and the situation becomes more complicated. The prolapse should be excised; however, sometimes the iris remains incarcerated in the wound.

Perforations in the ciliary body area are fraught with danger, for here is the most vulnerable spot of the globe. Enucleation subsequent to trauma in this location frequently could be considered conservative surgery, since it is this type of accident which most readily will give rise to sympathetic ophthalmia.

When foreign bodies enter the globe, or are suspected, x-ray is in order. It is relevant to mention that x-ray is also indicated in every case of unilateral cataract of unknown origin, as occasionally an intraocular foreign body is discovered. Opaque foreign bodies, as well as glass, may be visualized.

In the event of a double perforation of the globe with the foreign body lodged behind it, it is often unwise to attempt removal. However, if the foreign body is intraocular and magnetic, immediate extraction is imperative. A condition of this type should be considered an emergency. Early magnetic extraction ought to be done, for as the metallic body remains in the globe, the tissue walling it off tremendously increases its magnetic resistance. Removal of the metal may be attempted through the wound of entrance; however, when it is in the posterior segment of the eye the surgeon may decide to extract it through a scleral incision. It is suggested that if a magnet is available it be applied gradually to the wound of entrance. This maneuver may mean the difference between saving and losing an eye. Retained metals in the eye are not well borne. Frequently, the globe becomes inflamed, degenerates and is finally lost.

Nonmagnetic foreign bodies within the eye are more difficult to handle. Fortunately, today, they can be extracted under direct observation in most instances. Anteriorly they may be visualized with

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or without the aid of the corneal microscope, while posteriorly, they may be revealed by the ophthalmoscope, or the endoscope inserted through the sclera. Biplane fluoroscopy is also available.

In all perforated wounds, tetanus antitoxin should be administered and the advisability of one of the sulfa drugs and/or foreign protein considered. In ophthalmic practice the sulfa drugs do not play the prominent role that they do in other fields.

Nonperforating wounds of the eye seldom jeopardize eyesight. Foreign bodies on the conjunctiva or in the cornea are most frequently encountered. The most annoying foreign bodies are found on the everted side of the upper lid. A drop or two of local anesthetic placed in the conjunctival sac will greatly facilitate the removal of foreign bodies from the surface of the conjunctiva or cornea. A moist applicator is sufficient for this procedure while for those more deeply imbedded a spud is useful. Removal of a rust stain is essential and is best taken care of by a dental bur, rotated on its long axis.

Superficial lacerations and contusions as a rule are not serious and respond well to palliative therapy. Of course, the reason for this is the great protection afforded the globe by the surrounding bony orbit and its extraocular soft tissues. Occasionally we see a traumatic cataract, rupture of the choroid or separation or hemorrhage of the retina.

Burns of the eye call for exact care. If seen shortly after the injury, the eye should be irrigated many times with boric acid solution. After a drop of one-percent atropine has been instilled, castor or mineral oil could be dropped into the conjunctival sac. In the presence of pain, any of the anesthetic ophthalmic ointments could be employed several times with impunity. A glass mold to prevent adhesion of the globe to the lid (symblepharon) may be of value during the healing process.

In the event that an adhesion does develop, and it interferes with the free motility of the globe, a graft will be necessary. A burn sometimes is so severe that it causes complete destruction of the eye and conjunctiva. In such a case a prosthesis is preferable to a patch or blinder covering the deformity. An epithelial graft will permit the patient to wear an artificial eye. When the cornea is completely opaque a transplant is indicated. Several sources for the donor graft have been utilized. Scientifically, it has been found that cornea transplants give good results. Cornea obtained after electrocution may be used. If the corneal scar interferes with vision and if it does not cover the membrane entirely, as most often is the case, then the safer and more successful operation of corneal tattooing with optical iridectomy is the surgery of choice.

Sympathetic ophthalmia is the dread of all eye surgeons. It is a special form of uveitis, in which, as a result of injury or disease

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of one eye, an inflammation is set up in the fellow eye. To be sympathetic this inflammation in the fellow eye must be an actual inflammation and not sympathetic irritation which so often accompanies any badly injured eye. Irritation not alone consists of photophobia and lacrimation of the sympathizing eye, but also of a few deposits on Descemet's membrane. These few deposits, it is well to stress, are due to irritation, not to an actual sympathetic ophthalmia. Fortunately the disease is rare.

When to enucleate and when to preserve the eye are difficult decisions and will rest on experience. Several practical points however may be helpful. It is well to remember that seriously injured eyes, which on immediate observation appear almost hopeless, often change markedly in the first 24 hours. As long as an eye is healing, enucleation should not be considered. Purulent eyes practically never give rise to sympathetic ophthalmia. Another important fact is that there is a safe period of at least 2 weeks. An injured eye removed within 2 weeks, seldom, if ever gives rise to sympathetic ophthalmia and it is surprising how many severely injured eyes respond to palliative treatment during this period. Therefore it is suggested that the patient be given this 2-week period whenever possible.

A few of the extraocular orbital injuries may be noted. In general, all types of wounds are best taken care of directly. It should be the aim of the surgeon to secure healing by primary intention. Proper immediate care will save much plastic surgery later, and the cosmetic and functional results are far superior. These remarks apply not only to extraocular orbital injuries, but also to facial ones.

A deep tear of the lower lid at the medial canthus calls for its reattachment to the periosteum, posterior to the point of separation. In other lacerations of the lid margin, correct early suturing generally will prevent notching. Ectropion and entropion, too, require plastic repair. Following fracture of the orbit, with displacement of the fragments, there may be a depression within the orbital area. To remedy this, fascia lata works well as the filling tissue.

Simple burns of the lids are temporarily annoying. Extensive and deep burns give rise to almost any type of deformity. Grafts in these cases are often indicated. Free, full-thickness skin grafts from one of the other healthy lids serve best. In a patient with burns covering and destroying most or all of the skin of both lids, a large Thiersch graft may be utilized. Complete or partial loss of the eyelashes or brow calls for replacement or repair. With complete loss of the lashes, a full-thickness graft consisting of a thin strip of the brow takes well. A full-thickness graft of the scalp, either directly behind the ear, or in the occipital area makes a good brow. Partial defects of lashes or brow can be covered by sliding grafts.

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EARLY SKIN-GRAFTING OF WAR WOUNDS

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The increased use of fire power in modern warfare has resulted in great numbers of burns of a third-degree nature and of wounds completely denuded of every layer of skin. Regardless of what medication is applied, these areas will require skin-grafting. Unless this is done, contracture and deformity usually ensue. The wide use of blood plasma and sulfonamides has resulted in more survivals of those with severe injuries, with the result that more skin-grafting has been required.

Skin-grafting is delayed too long in too many instances. When the surgeon has determined that all the deep glandular epithelium of the skin has been destroyed in an area of reasonable size and that grafting will be required, then it should be done early. Unless this is done, healing will occur from the sides of the wound with resulting deformity and contracture. The postulate of Blair (*1*), that the time required for healing in an area completely denuded of skin is in direct proportion to the size of its square surface, has been borne out clinically. Thus an area 2 inches square will take 4 weeks to heal, an area 4 inches square 16 weeks, and an area 12 inches square will take 144 weeks to heal.

Early skin-grafting of massive denuded areas, whether these were caused by burns or wounds, is indicated to save life and to prevent contracture deformities by fostering early movement. Autogenous skin grafts are preferred, but in extensive burns large transplants of skin from another person may be employed as emergency dressing. This procedure stops pain, improves the general condition of the patient by preventing loss of body fluids, and removes the wound stimulus to the production of the dense, avascular, deforming, fibrous tissue that usually accompanies the spontaneous growth of scar epithelium.

Koch (*2*) set forth certain important principles in the treatment of burns. He emphasized treating burns like wounds by (1) thorough cleansing and debridement, (2) handling the tissues with great gentleness, and (3) the avoidance of adding infection from one's own person, as from the nose or mouth. These principles can and should be carried out regardless of the locale in which the surgeon finds himself.

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The type of skin graft to be used to cover a required area is often important. Whether the graft is to be autogenous or not must be decided, as well as the thickness of skin transplant. Often patients with severe injuries are not in physical condition to contribute their own skin at the time, or the burn area may be so large that sacrifice of more skin would create problems in nursing management. It is in these cases that homografts may be used as a life-saving expedient.

A great deal of work on the use of homografts has been done by Lexer (*3*), Perthes (*4*), Holman (*5*), Brown (*6*), and Padgett (*7*), and apparently neither the fact that donor and recipient may be of the same blood type, nor that the most attentive aftercare is provided, greatly influence the "taking" of the graft. For all practical purposes grafts from one person to another do not take. Brown (*8*) had one case of identical twins in which a split skin homograft was successful. However, cases of this type are both rare and anomalous.

Nevertheless homografts may be indicated, especially in individuals who have massive burns or wounds accompanied by an elevation of temperature, anorexia, and general dehydration. The pieces of skin taken from another individual serve as an emergency covering or dressing permitting the patient time to regain strength during the 5- to 9-week period that such grafts remain viable.

All homografts usually show practically the same clinical characteristics, in that for the first 2 or 3 weeks they appear to have taken. They seem to gain color and blood supply, and then they eventually peel away, leaving the original granulating surface. However, during the interim of weeks, the patient has been much more comfortable and, following such procedure, he may be in much better condition for autogenous grafting.

The donor site will depend upon the area to be grafted. If the recipient area is some large flat surface on the body, then a split skin graft of the required thickness may be taken, usually from the thigh or abdomen. When skin is taken for use above the clavicle, the donor site must be chosen more carefully; thus the opposite eyelid or the posterior aspect of the ear is most appropriate for lid grafting because of the characteristics of the skin in these areas. Mucous membrane may be taken from the mouth to replace conjunctiva when an area on the eye requires grafting. For restoration of a defect in a hairless area of the face, skin must be obtained from some other hairless site (as the inner part of the thigh or the upper and lateral portions of the abdomen), otherwise the hair follicles included in the graft may give the patient future discomfort. Epilation by x-ray or electrolysis has not been very satisfactory.

After taking a split skin graft the donor area is treated as a second-degree burn by applying parresine mesh impregnated with vaseline,

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over which is laid sterile gauze; then a pressure bandage is applied and held in place with stockinet. Recent studies by Meyer and Gradman (*9*) and Hirschfeld et al. (*10*) have confirmed our belief that this method of treating burns and fresh wounds is definitely superior to other methods in that the healing is usually uneventful. There is no pain or discomfort, and no appreciable scarred area remains. When a full-thickness graft is taken, the defect is closed by one of two procedures, depending upon the size. If it is small enough, the adjacent skin is undermined, and the edges maneuvered into position by approximation. If it is too large for such closure, a split skin graft is taken from an opposite area to cover the primary donor site (*11*).

The thickness of the graft will depend upon the recipient area. With the advent of more precise methods of cutting a split skin graft, using a Padgett's dermatome, a choice between a full-thickness graft and a thick split skin graft is offered (*12*). Some plastic surgeons feel that full-thickness grafts should always be used above the clavicle, contending that there will be less contracture, less scarring, and less depigmentation. Such grafts more closely approximate the adjacent tissues. However, a thick split skin graft cut by modern methods has all these advantages and at the same time leaves sufficient subepithelial elements in the base for early spontaneous regeneration without the necessity of grafting or maneuvering new skin onto the donor site.

Often large pieces of skin are needed from the thigh or abdomen to cover burns of the extremities, burn areas of the mouth, and over the mandible. In such lesions, and also wherever massive repair of burns becomes necessary, the thick split graft is of advantage. It lends itself more readily for purposes of surgical manipulation.

The thinner the graft the more likely a successful take. In areas where low-grade infection is suspected, thin grafts are to be preferred. The disadvantages of a thin graft are obvious. There is much more chance for contracture, scars, and depigmentation. However, if the graft is for the fingers or hand, and the tendons are not exposed, the presence of a fat pad with the graft is not necessary.

It is often difficult to distinguish between a severe second-degree burn and a total third-degree burn with complete destruction of the deep glandular epithelium. In such cases, however, pressure dressings are used over the initial injury to prevent the accumulation of surface fluid and to lessen edema. The dressings are removed after sufficient time has been allowed for any subepithelial glandular elements to appear on definite third-degree burns. Immediate grafting may then be done. There is no harm in early skin-grafting in cases of severe second-degree or possible third-degree burns. It has been our experience that the third-degree areas will readily accept the new skin, and that in severe second-degree burns, if any deep glandular epithelium is

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present in the derma, it will soon assert itself and the graft will ultimately peel off.

Frequently infection is present in an area requiring a graft. Every effort should be made to eradicate infection before attempting grafting. Wet antiseptic dressings in conjunction with the heat cradle, the sulfonamide drugs and other therapy should be instituted. Often partial control of the infection will permit some epithelization; as new skin grows into the area the infection recedes.

At times it may be possible to graft skin onto an area of suspected low-grade infection. In these cases the thickness of the graft should be gaged carefully; the thinner the graft the better is its chance of taking. A catheter with numerous holes cut into the end may be placed within a voluminous dressing of mechanic's waste or sponge, and the grafted area irrigated every 2 hours with 4 ounces of boric acid solution. It has been our experience that very often a graft so applied will take in an infected area. Thus, by providing some covering for the area, early movement, prevention of deformity, and control of the infection will be obtained. Sometimes it may be necessary to undermine the surrounding skin in order to gain covering for the defect. Adhesive bridges along the edges will encourage epithelial cells to penetrate farther into the wound, thereby decreasing its size.

Certain areas of the body, depending upon the size of the defect, may demand more than a split skin graft or full-thickness skin graft. A wound over the tibia may primarily take a graft, but experience has shown that the least trauma will cause a slight slough and eventual breaking down of the entire area. The surgeon may at his discretion use an adjacent flap, a flap transferred from some other part of the body, adjacent pedicled tube, or a tube flap staggered to a new position.

In severe burns when the depth of the wound is such that, though it might accept a graft, the resultant depression of the defect would be cosmetically too deforming, a pedicled skin flap or tube should be utilized. A pedicled flap is indicated for fingers where a phalanx is exposed and it is necessary to cover it to avoid amputation; to add length to an amputated member; and where tendons are bared. Frequently in the presence of low-grade infection the initial tendon transplant may have to be omitted. In these cases a skin tube or pedicle may be more desirable.

A pedicled flap is also indicated over any area where bone is near the surface, such as over the tibia or over a joint. The tubed or pedicled flap is usually necessary in denuded wounds over the heel or sole of the foot, primarily because they are weight-bearing areas. At times wound areas will break down in the presence of extensive scarring, especially when the wound is a burn. In cases of a central scar defect, in an area where there is insufficient blood supply to support

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a graft, the circulation must be obtained from some other area in the form of a pedicled flap or tube.

A skin flap or thick covering is also necessary at the end of an amputated stump, especially where a guillotine operation has been performed previously, and it is not desirable further to shorten the stump. Pedicles and tubes are also often necessary in plastic surgery about the head or neck, in the reconstruction of all or parts of the nose or ears, and in the covering of large defects of the face.

It is most important that the patient's general condition be considered in conjunction with the problem of skin-grafting. Patients who have sustained wounds in combat zones are sometimes already below par from battle stress. The surgeon's enthusiasm for operative procedure must be governed by the patient's ability to withstand intercurrent infection. Also when any appreciable area is to be grafted, the problem of surgical shock must be considered. Diet, fluids, vitamins, and other supportive measures to improve the general body resistance and the condition of the skin are most important before selecting the time, area, and type of graft. Blood transfusions prior to instituting skin-grafting may be of great value.

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FACTORS INFLUENCING THE CHOICE OF SKIN GRAFTS

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The decision as to what type of skin graft should be selected to cover a subcutaneous defect is not always an easy one to make, but the degree of uncertainty lessens as the surgeon's experience with various technics increases. The inexperienced operator is apt to choose more complicated methods when a simpler procedure would be more desirable, the latter method not only yielding better final results but also saving time and discomfort on the part of all involved.

The type of skin graft should always be carefully and properly selected. In general, the thinner the graft, the greater will be its chance of taking. However, the thin graft will give the poorest cosmetic and functional result. Conversely, the thicker the graft, the more difficult it will be to obtain complete growth, but the maximum degree of function and cosmesis will be obtained.

The following simple classification of skin grafts is suggested:

- Free grafts
  - Split thickness
    - Thiersch
    - Reverdin
    - Intermediate
    - Stent
  - Full thickness
- Pedicle grafts
  - Simple
  - Tuned

FREE GRAFTS

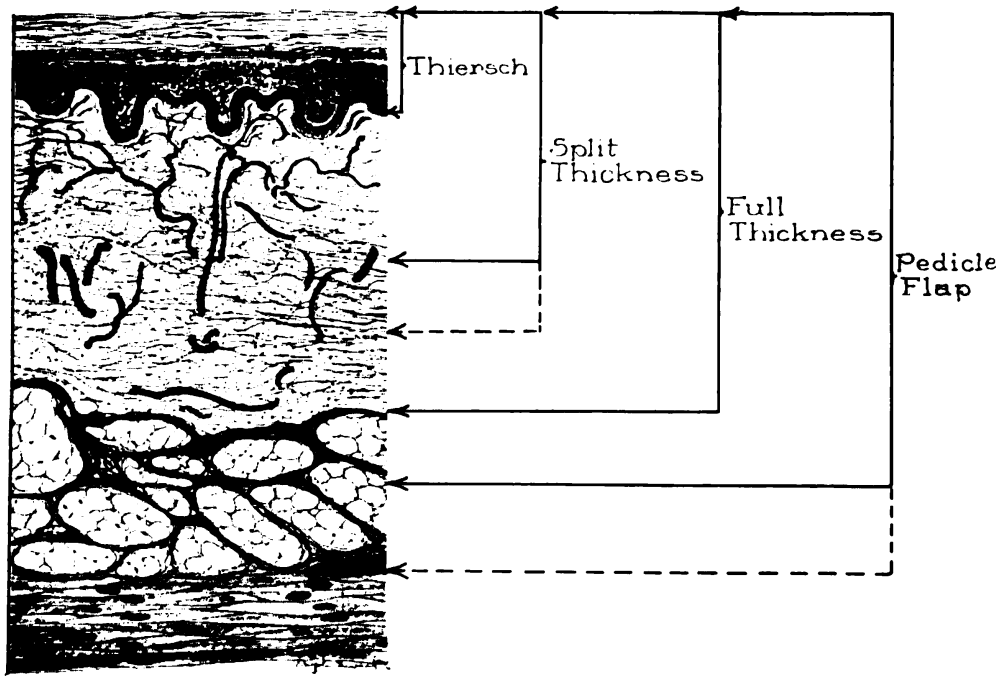
Free grafts should always be given first choice, but they should be used only when there is a healthy base against which pressure can be applied.

The Thiersch graft, a very thin, epidermal split-thickness type, is extremely useful for the rapid covering of any surface defect. It is sure to take if certain simple rules are observed. It grows well even in the presence of considerable infection and can often be utilized to convert an infected granulating defect into a closed wound. It will grow well on any fresh wound, periosteum, perichondrium, muscle, fascia, tendon, or in the mouth. It will not, however, control the underlying fibrosis which invariably develops postoperatively. But it will grow where a graft of greater thickness might not survive.

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As a temporary measure, therefore, whether for a burn or other cutaneous defect, it can often be utilized to great advantage in facilitating rapid healing. Moreover, this covering may be excised later when the operative wound is clean and a thicker graft can be applied successfully.

Reverdin (pinch or Davis) grafts may have a place in the hands of the occasional operator or to serve as a temporary covering. Their use might be considered in extensive burns when donor sites are at a premium. However, it has been the experience of many that the percentage of takes is much greater when large sections of skin (as Thiersch grafts) are used.



1. Showing depths to cut for different types of grafts.

The final functional and cosmetic result with the Reverdin graft leaves much to be desired both in the recipient and donor areas. The scarring between the islands of skin frequently breaks down due to its poor vascularity. Not only does this predispose to infection, but epidermoid carcinoma has followed the chronic ulceration that may develop. It therefore appears that the Thiersch graft is preferable to the pinch type.

Grafts of intermediate thickness undoubtedly have the greatest usefulness of all the various types. These might be called thick Thiersch grafts. They can be cut from 25 to 85 percent of the total skin thickness. The thicker ones have many of the advantages of the free full-thickness skin grafts and are much simpler to handle. They may be cut to almost unlimited surface dimensions. It is not

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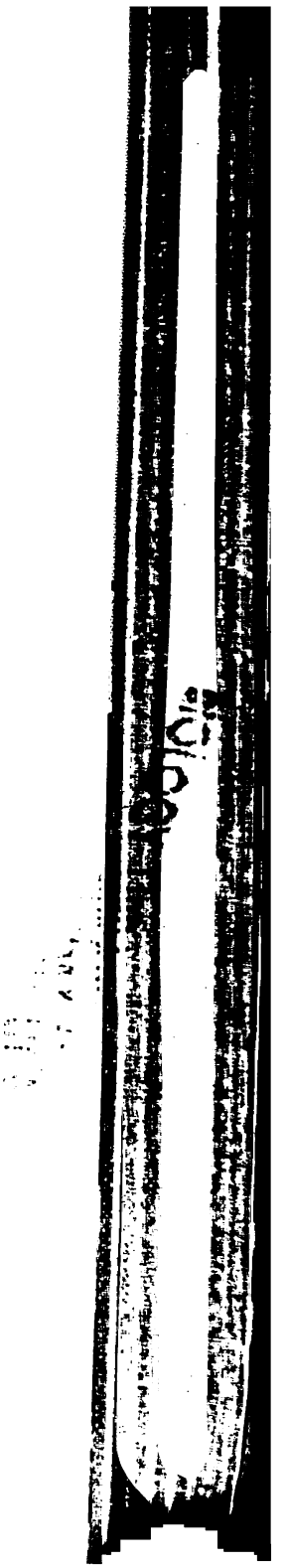
necessary that they be cut to exact size, since any excess may be permitted to overlap and later be trimmed off at the time of the first dressing. Further, the donor site heals spontaneously. It has been my experience that thick split-thickness grafts may be used for all practical purposes in many areas where formerly the more complicated free full-thickness graft was employed. There is ample proof that these grafts will function well on practically all defects of the extremities except the flexor aspects of the hand. They may be used here providing a good subcutaneous fat pad is present on the recipient site. Even neck and axillary contractures do well when replaced with large, thick, split-thickness skin grafts.

Another advantage of the split-thickness graft is that repeated "crops" of grafts may be cut from the same donor site at 3- to 4-week intervals when large quantities of skin are necessary to cover extensive defects.

In providing an epithelial covering over irregular surfaces and in cavities, it is often difficult to obtain firm, even pressure. This can be carried out successfully if the graft is applied over a mold cast of the defect. These molds are made with a dental modeling compound; hence the grafts are called Stent grafts. After applying a split-thickness graft over the prepared mold, with the raw surface of the graft outward, the mold is reinserted into the cavity and pressure applied as with any other graft.

Free full-thickness (Wolfe) skin grafts will give the maximum degree of cosmetic and functional result, but are the most difficult in which to obtain growth. They are preferred when a free graft for reconstruction about the face is desired, or in dealing with flexor defects of the hands and fingers. They will grow best on a clean operative wound and should be applied to an area in which there is a good subcutaneous fat pad. They are freed of all underlying fat, cut to a pattern the exact size and shape of the defect, and are secured in place with many small interrupted sutures. Hemostasis of the recipient area must be perfect. Pressure should be applied for 14 to 21 days, although the graft may be inspected earlier for the removal of sutures. However the pressure must be reapplied immediately.

There does not seem to be any limit as to the size of the full-thickness graft, but the donor area may create a serious problem in closure. Smaller donor areas can be closed by undermining and suture, but large areas may have to be covered with some type of split-thickness graft. Consequently there should be very definite indications for its use when a free full-thickness graft is selected.



PEDICLE GRAFTS

Pedicle flaps must be used in extensive reconstructions about the face, particularly about the mouth and tip of the nose where both

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covering and lining are needed, and when there is not a healthy base against which adequate pressure can be made. They are also indicated when it is doubtful whether the viability of the graft can be maintained and when it is necessary to transfer a subcutaneous fat pad with the graft. To cover defects of the hand when tendons have been exposed, a flap containing a good subcutaneous fat pad is a necessity, but a free graft should always be used when there is an adequate subcutaneous fat pad over the tendons. However, any flap on the hand or fingers is always bulky and clumsy as compared to a free graft.

An attempt should always be made to select a graft that will match the area to be covered, both cosmetically and functionally. For small defects about the face a free full-thickness graft from behind the ear or inner aspect of the upper arm matches quite well.

For split-thickness grafts, the back, abdomen, and thigh will yield the largest donor areas. The normal total thickness of any split-skin graft varies with the donor site, i. e., whether it is on back, abdomen or thigh, and whether on a man, woman, or child. In other words, a graft, cut with a dermatome set to 0.0024-inch thickness, from the back where the skin is relatively thick, would be carried into the subcutaneous fat if it were taken from the inner aspect of the thigh on the same man. The transplantation of skin from a hairy donor site must be avoided if one does not wish to have the recipient area covered with hair.

Isografts, according to present-day experiences, are unsuccessful except in identical twins. This latter consideration will arise only in remote instances. However, thin Thiersch isografts may grow from 1 to 3 weeks before melting away. This fact may be of value in the temporary covering of an extensively burned individual who is too ill to have autogenous grafting. While the outcome is definite failure, the temporary growth may tide over a critically ill patient until autogenous grafting can be done successfully. Zoo-grafting, the transfer of animal skin to human beings, is spectacular but has not been successful.

CHOICE OF GRAFTS

In choosing the type of graft to use in any given case the following considerations must be kept in mind:

1. The ease with which the defect may be covered.
2. The final cosmetic and functional result.
3. The comfort and safety of the patient during the period before plastic surgery may be successfully accomplished.

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PLANNING THE TYPE OF REPAIR

In planning the repair of any defect, the surgeon must visualize the final result and then decide upon the steps necessary to bring about a successful result. He should apply his selected graft as early as possible, using the simplest method that will give the desired cosmetic and functional result. If it is necessary to use some type of pedicle flap, such a flap must be completely prepared and ready for transfer before removing pathologic lesions, such as contractures and neoplasms, from the recipient area.

CONCLUSIONS

Free grafts must always be given first choice for reasons of simplicity and when there is a healthy base against which pressure can be made.

A split-skin graft will serve to cover the greater majority of all cutaneous defects. This type of graft is identical in consistency and character, whether it has been removed with a dermatome or razor.

Pedicle grafts are necessary when: (1) It is doubtful whether the viability of the graft can be maintained. (2) When a subcutaneous fat pad is to be transferred with the skin covering. (3) When both lining and skin covering are needed. Simple pedicle flaps are best when they can be rotated from an area nearby. Tube pedicle flaps are chosen when the skin is to be obtained from some distant point.

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GRAMICIDIN AND PENICILLIN

Gramicidin is a highly effective antibacterial substance for most gram-positive pathogens. It is considerably less toxic for tissues than most germicides in use at present. Gramicidin behaves like an anionic detergent and is hemolytic. For this reason its clinical use is restricted to local application and to implanting it into infected cavities.

Penicillin is also a highly effective antibacterial agent against a variety of pathogenic organisms. Penicillin is even less toxic for tissues than gramicidin. Penicillin does not behave as a detergent-like substance and is not hemolytic. Penicillin may be administered locally, subcutaneously, intramuscularly or intravenously without evidence of toxicity. Penicillin should prove of great value in the treatment of severe infections. In using penicillin the principles concerned with its somewhat selective antibacterial activity should be adhered to strictly. Neither gramicidin nor penicillin can be substituted for sound medical and surgical judgment so essential in the management of bacterial infections.—Herrell, W. E.: Gramicidin and penicillin. S. Clin. North America **23**: 1163–1176, August 1943.

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THE FITTING OF SHOES FOR NAVAL PERSONNEL

CHARLES F. FERCIOT
Lieutenant Commander (MC) U. S. N. R.

In order to determine the efficiency of shoe fitting for naval personnel, a study was made on a group of 150 men.

Standards for shoe fitting have been established not only by manufacturers but by various research groups and it is generally agreed that the following three considerations are of prime importance:

1. Suitable length of the shoe from heel to ball of foot.
2. Fit of shoe about the heel.
3. Fit of shoe over instep and forefoot.

The following points were studied:

1. The position of the ball of the foot in the shoe in full weight-bearing was marked on the inner side of the sole of the shoe.
2. The weight-bearing footprint was taken, marking the position of the back of the heel, the ball of the foot, and the ends of the toes.
3. The shoe was placed over the print with the ball of foot markings superimposed and a rough outline of the shoe traced around the print.

This record closely approximated the position of the foot in the shoe during weight-bearing.

It was found that the prints supported the clinical observation that these men have excellent functional feet from a structural standpoint. Varying degrees of cavus or high arch were found in 11 instances, planus or flatfoot in 7, moderate bunion in 3, and overlap of the 5th toe in 1 case. In view of the fact that the Naval issue shoe is ideally suited for the fitting of relatively normal feet, it would appear that well-fitted shoes should be the rule. Such a supposition however, is not borne out by the findings of this study.

Out of this entire group, fitting as to length was found to be ideal in only 8 instances. In 44 instances the shoe was only one-half size short. Granting that in a normal or symptomless foot this degree of shortness might be considered as satisfactory, it was seen that less than 35 percent of the group could be considered as wearing well-fitted shoes. The remaining 98 men were fitted in shoes that were from 1 to 2½ sizes short. Sixty-four were 1 size short, 29 were 1½ sizes short, 4 were minus 2 sizes, while 1 lacked 2½ sizes.

From the consideration of width on the other hand, fitting was found to be adequate in nearly every instance, although the fact that

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so many of the men were fitted in short shoes prevented the full utilization of width. In this condition the wide portion of the forefoot always comes anterior to the widest part of the shoe.

The purpose of a shoe is of twofold nature, to support and protect the foot and to facilitate free functional activity. To accomplish this it is naturally constructed to conform as far as possible to the design of the foot itself. That portion fitting from the heel to the ball of the foot is of quite sturdy construction and the sole of this part (the shank) fits up under the relatively rigid long arch of the foot, thus bearing part of the static strain incident to standing or walking. The forepart of the shoe is designed to permit full action at the metatarsophalangeal joints as well as to afford protection to the toes.

Since the shoe is designed to bend at the ball of the foot, it is evident that this fitting is of particular importance. In a short-fitted shoe the shank can afford no support to the long arch since it does not come in contact with it. In fact it tends to place an undue strain upon the arch through the downward pressure of the tight lacing on the dorsum of the foot. A short shoe crowds the forefoot into a somewhat wedge-shaped space which limits functional activity and thus removes a large part of the "spring" from the walking gait. Such shoes cause strain, not only to the ligaments and muscles of the foot, but also produce undue pressure on the back of the heel and under the metatarsal heads. They promote calluses on the back of the heel, under the forefoot, and along the inner side of the great toe. Ingrown toenails are common along with bunions and corns.

The problems of postural balance in relation to the walking gait are too complex for consideration here. From a clinical viewpoint, however, there is little doubt but that a definite relationship exists between foot imbalance and postural strains. This is often evidenced by seemingly unrelated complaints.

To insure the proper length fitting it is only necessary to make one simple measurement, that of the length of the foot from the back of the heel to the end of the toe in full weight-bearing position. A careful review of this entire group confirms the fact that had the indications of this simple measurement been followed, a satisfactory length fitting would have resulted in every instance. If no measuring device is available, one can readily be constructed with the aid of a ruler. A foot measuring 10 inches in length should be fitted in a size-8 naval issue shoe, and each variation of one-third inch represents one shoe size. Thus an 11-inch foot would require size 11 while a 9-inch foot would be fitted in a size-5 shoe.

Considerable confusion has arisen because of the variation in size designation between the Naval issue and civilian shoes. The former is actually one size longer than the same civilian size. This study

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reveals that it is a common practice to issue the new recruit a shoe one numerical size shorter than he had worn as a civilian, rather than rely upon the actual length measurement of his foot. In view of the general tendency toward short fitting it would be much more satisfactory when for any reason fitting must be done without measurement, to issue the recruit a shoe of the same numerical size worn in the civilian shoe. It seems probable that this was the intent when the present size designations were instituted.

A consideration that is of practical importance to the supply officer is that if shoes are fitted in proper length, it will be necessary to stock narrower widths in all sizes, since with the added length there is also an increase in width amounting roughly to one letter for each half size in length. Thus a man wearing a size-8E shoe on a size-9 length foot would likely be best fitted in size 9C. It would thus be necessary to stock from A to D widths largely, rather than from C to F widths as is frequently done at present.

It was found that in the well fitted issue shoe there was approximately 1 inch of free space between the end of the toe and the end of the shoe. In the short fitted shoe this distance was lessened just the amount that the ball of the foot fitted anterior to the wide part of the shoe. Men afloat are said to complain that this amount of toe space is a handicap in going up and down ladders and prefer a short-toed shoe. If this prevalent feeling has factual bearing, and it would appear that it does, a minor change in design would afford a short-toed shoe that would at the same time fit the foot properly. Just why the issue shoe is designed to allow a full inch of free toe room may be questioned, particularly since such a shoe is so conducive to short fitting.

A clinical survey of shoe adaptation in a group of WAVE personnel indicates that as a whole they tend toward short fitting even more than men. This may be explained in part by the female preference for higher heeled shoes and the less active program they followed prior to enlistment. It is felt that a great deal of lost time, suffering, and expense might be avoided if the method of shoe fitting by measurement was practiced on induction.

The fitting of shoes to be worn in cold climates requires careful attention to assure adequate space for heavy socks without any constriction of the circulation. The socks should be worn when the shoes are fitted, as it is frequently found that a full extra size in both length and width is required under these circumstances. The previously mentioned principles of length fitting are particularly applicable in this instance, as any pressure area greatly increases the hazard of frostbite. An incidental observation of considerable practical importance in the treatment of persistent fungus infection of the foot is that these

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cases respond much better to treatment when placed in properly fitted shoes which provide adequate toe space, thus favoring the circulation of air in the shoe, the reduction of inside shoe temperature, and a lessening of perspiration.

SUMMARY

1. Short fitting of shoes is common among Naval personnel.

2. Misfit shoes frequently cause impairment of foot function and postural imbalance which results in disability and loss of efficiency.

3. Fitting of shoes by actual foot measurement in the full weight-bearing position should be routinely practiced.

4. The possibility of developing an improved last for Naval personnel afloat is suggested.

5. Particular care should be taken in fitting when cold-climate duty is involved.

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SULFAMERAZINE

It appears that sulfamerazine, by virtue of its pharmacologic behavior, therapeutic efficacy and low toxicity, offers definite advantage over sulfadiazine and is worthy of extensive clinical trial.

Sulfamerazine has been used in the treatment of 400 patients with a variety of acute infections. From a pharmacologic standpoint, it appears that sulfamerazine is a more satisfactory drug than sulfadiazine in that higher blood levels are attained more rapidly and sustained longer by sulfamerazine than by similar amounts of sulfadiazine. Thus, it is possible to maintain a given concentration of drug in the blood with smaller amounts of sulfamerazine than sulfadiazine. Likewise, this feature of sulfamerazine may prove it to be superior to sulfadiazine as a *prophylactic agent*. Furthermore, the rapid absorption obtained with sulfamerazine frequently makes the parenteral use of the drug unnecessary.

The therapeutic results obtained with sulfamerazine in the cases of pneumococcal and meningococcal infections are comparable in every respect with the results obtained by us with sulfadiazine. In the other conditions in which sulfamerazine was employed the limited number of cases involved prevents a definite comparison, although it appears that sulfamerazine is as effective as sulfadiazine in the various infections in which it was used.

In general, the toxicity of sulfamerazine is low and is no greater than that of sulfadiazine. The fact that urinary complications may occur makes the routine use of alkalis advisable.—Flippin, H. F.; Reinhold, J. G.; and Gefter, W. I.: Sulfamerazine; clinical evaluation in 400 cases. M. Clin. North America 27: 1447–1461 November 1943.

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OBSERVATIONS UPON THE APPARENT INCREASED INCIDENCE OF CENTRAL RETINO-CHOROIDITIS

The pathologic picture varies from a faint stippling of the macular area, with little if any lowering of visual acuity, to a definite "hole in the macula" with edema and 50 percent or more loss of vision. Occasionally there is a definite degeneration with patchy exudate and pigmentary deposits. Quite frequently the condition is unilateral.

Occurring in a group of young individuals who are supposedly fit at the time of enlistment or commission and whose vision is recorded as normal in their health records, it excites interest as to the probable etiology.

Various etiologic factors have been considered: Syphilis, tuberculosis, focal infection, vascular spasm, allergy and phototraumatism.

In the cases I have seen, syphilis has not been a factor. Tuberculosis has been ruled out clinically, confirmed in some cases by x-ray of the chest. Mantoux tests were done in a few cases and were negative or mildly positive, as one would find in an average group. I have not been able definitely to attribute the condition to a focus of infection.

The macular tissue is easily injured by vessel disturbances, both because of the fine vessels supplying this area and because of the highly sensitive type of nerve tissue there. Even temporary narrowing of retinal capillaries can cause considerable and permanent damage. I am aware that some investigators have established reasonable arguments that there is an actual angioneurotic constitutional peculiarity with reference to retinal capillary spasm, analogous to migraine and intermittent claudication.

I feel quite sure that migraine is due to spastic narrowing of certain vessels in the brain, but the precipitating factor, or "trigger," is not always readily apparent. It seems to me to be quite logical to assume that psychic trauma induced by fear, worry, and shock of war duty, especially in an individual with the hereditary angioneurotic constitutional make-up, may easily produce capillary spasm and thus initiate degenerative changes in the macular area. An edema of the subretinal tissues is produced and the stippling which appears later is an infiltration of the external retinal layers. The spasm also probably involves the underlying choroidal vessels.

The fact that the lesions seem to occur during the summer or in hot tropical climates speaks for a possible allergy (pollen sensitivity). On the other hand, in this same geographical area, the retina is exposed to a tremendous amount of actinic insult.

All ophthalmologists have observed the marked edema of the retina which results from exposure, for even a very short time, to the electric welder's "flash." It does not seem illogical that continuous phototraumatism of intense sunlight may produce similar pathologic conditions. I suggest that a combination of capillary spasm plus phototraumatism could produce the pathology under discussion, and account for its unilateral tendency.—Commander C. E. Harner (MC) USNR, Staff Conference, U. S. Naval Hospital, Pearl Harbor, T. H.

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CLINICAL NOTES

LIPOID PROTEINOSIS (URBACH-WIETHE)

REPORT OF A CASE

ALEX D. CAMPBELL
Lieutenant (MC) U. S. N. R.

Sulzberger (*1*) in a report published in 1942 collected 28 authentic, previously published cases of lipoid proteinosis and added one of his own. Only 6 of these cases were from American sources. Since that time one other case has been reported (*2*). The present report brings the total number of cases in the literature to 31. This condition presents a distinct clinical entity which once seen will be thereafter easily recognized. In the case to be discussed the location and appearance of the lesions so nearly duplicated those of Sulzberger's case that the photographs could almost be interchanged. However, because of the rarity of the disease many of these cases have gone unrecognized for years.

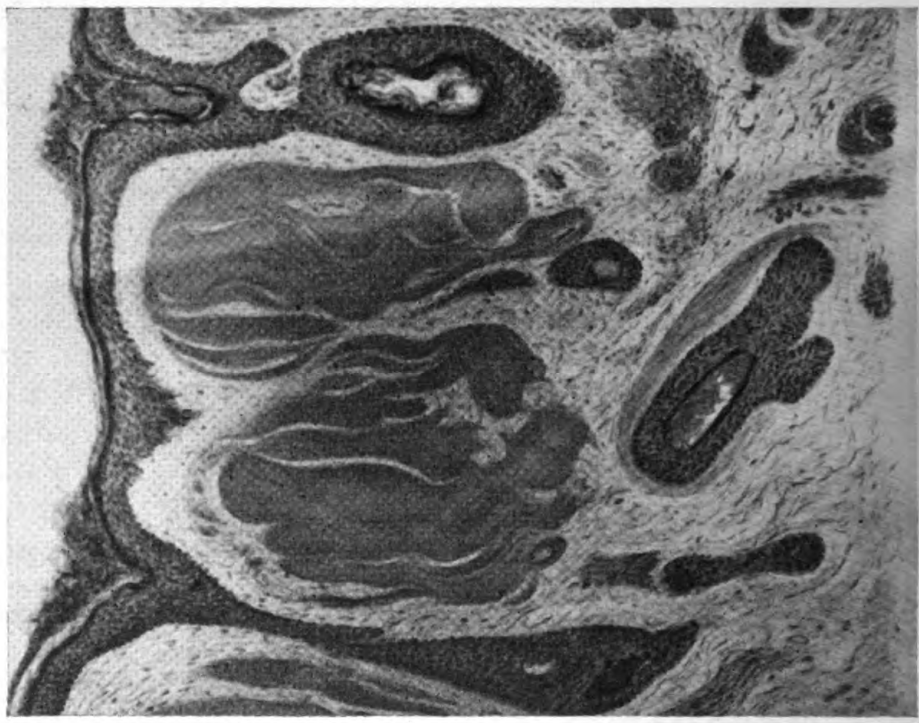
A case of lipoid proteinosis was first described by Siebenmann (*3*) in 1908. During the next 10 years several cases were recorded under various names. The familial aspect of the disease was properly emphasized, but its true nature as a metabolic disturbance with deposits of lipoid-protein material in certain tissues was not recognized until histologic and histochemical studies were made by Urbach and his associates (fig. 1) (*4*) (*5*).

The patient with lipoid proteinosis relates a history of having been hoarse since infancy. Other members of the family often are similarly afflicted. The patient finally consults a physician either because of mouth and throat lesions or because of skin involvement. The common immediate complaints are hoarseness, thickening of the tongue and lip, and choking spells. In 8 of the 14 cases compiled by Urbach, choking was so severe as to necessitate laryngotomy.

On examination the lower lip and tongue are found to be massively infiltrated and yellowish white in appearance. The affected areas have an irregular surface and in the hard, infiltrated area nodular lesions are palpable. The frenulum linguae has in most cases been thickened and shortened. The gums have never been reported as being affected.

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The mucous membranes of the cheeks are in most cases the site of some lesions, but the pharynx and vocal cords are involved to a much greater degree. The vocal cords are usually so scarred and thickened that the voice is almost a coarse whisper. Often nodular crusted lesions of the face develop, which on healing leave pocklike scars. The extensor surfaces of the elbow, knee, and finger joints are often the site of hyperkeratotic lesions, and almost without exception rows of



1. Microscopic section of illustration from Urbach and Wiethe, and republished through courtesy of Dr. Erich Urbach, showing large homogeneous masses of lipoid material in the cutis. Sudan III stain.

nodules are seen along the margins of the eyelids. Less frequently lesions have been reported inside the nose, on the genital mucosa, and about the rectum or scrotum. The scalp hair is often described as being thin, and in some cases dental anomalies, particularly the absence of lateral incisors, have been noted.

CASE REPORT

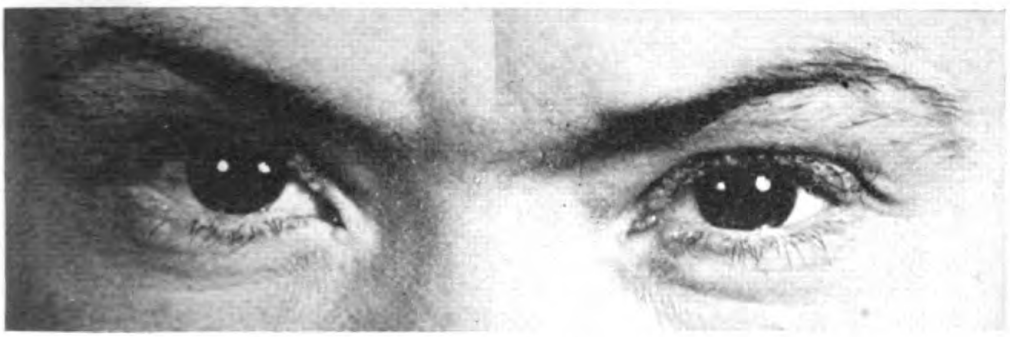
A thin, poorly developed woman, age 23, was first seen in the out-patient department complaining of a painful ulcer on the tongue.

There was no family history of hoarseness, skin disease, or diabetes, except that the brother of the patient's maternal grandfather had been hoarse all his life. The patient's three siblings are said to be normal. There was no consanguinity of the patient's parents or more remote ancestors. The patient stated that at the age of 9 months she had had diphtheria and had been hoarse since that time. As long as she could remember her lower lip and tongue have

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been thickened. During the past several years she had frequent choking spells, which sometimes lasted for several hours and caused considerable cyanosis. Her general health had been good and she had no other serious illnesses. About 3 years ago she had an ulcer, similar to the lesion of the present complaint, on the anterior third of the tongue. This lesion was very painful and took several weeks to heal.

All positive findings upon physical examination were those referable to the skin and mucous membranes. The entire lower lip was massively infiltrated, thickened, and protruded. The mucous membrane surface was irregular, of a whitish-yellow color, and on palpation many thickened lumpy areas were felt. The involvement stopped sharply at the gums, which were normal. The entire tongue was markedly thickened in the same manner as the lip. The surface was irregular and of the same yellowish-white color as the lip. On the anterior third of the dorsum was a contracted, irregular scar, the site of the original ulcer. The frenulum linguae was thickened and shortened, resulting in considerably decreased motility. On the posterior third of the dorsum of



2. Note translucent nodules along margins of lids.

the tongue was a very painful ulcer the size of a dime. Its base consisted of friable, reddish granulations covered by a dirty gray membrane. The margins were irregular and undermined. The lesion had healed at one side and progressed at the other.

Scattered over the pharynx were numerous yellowish-gray papules the size of a pinhead which extended down to the vocal cords and affected them extensively. They were thickened to about twice their normal size and were rigid. They were scarred but active lesions were no longer present.

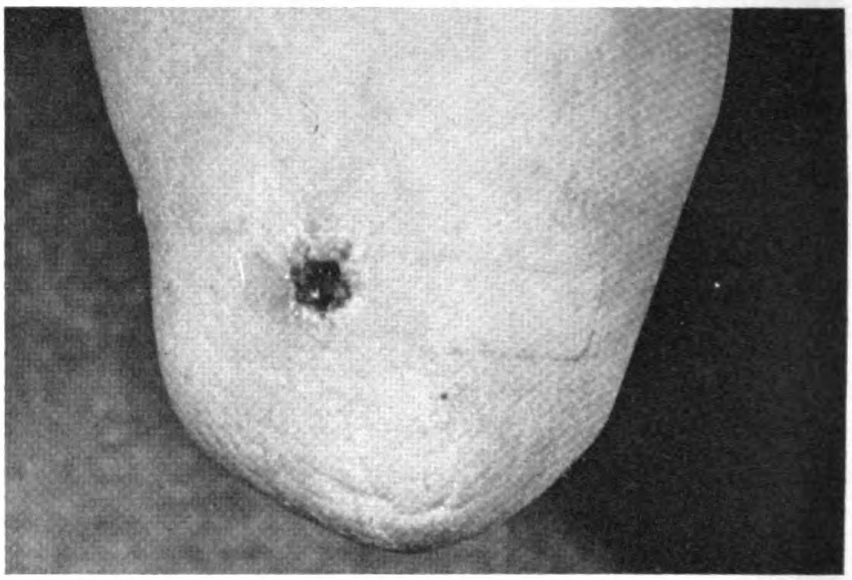
Along the margins of each eyelid (fig. 2) there was a row of hard yellowish-white papules. They seemed to have a follicular arrangement, with one or more eyelashes penetrating each papule. These lesions had been present for many years. Beginning lesions were also present on the extensor surface of the arms just below the elbows (fig. 3). The skin for an area of 5 centimeters in diameter was slightly thickened and of doughy consistency. The color was a dirty yellow and the skin lines were somewhat accentuated. In each axilla and around the rectum there were similar early lesions. There were no lesions or scars of the face.

A rather complete clinical laboratory workup of the patient resulted in all negative findings. X-ray examination of the skull, particularly for lesions of the Hand-Schüller-Christian type revealed nothing conclusive. Unfortunately because of the isolated location of this station and the difficulty in obtaining accurate results on old blood, it was not possible to have the blood phosphatids or total lipids estimated.

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A section for biopsy was taken from the lesion on the elbow and prepared at the Mayo Clinic. A specimen from the lip would have unquestionably shown much more marked changes; however, as the patient apparently had very poor healing powers as far as the infiltrated mucous membranes was concerned a biopsy of the lip was not believed justified. The clinical diagnosis of lipoid proteinosis was made at this time.

Histologic examination of the sections showed a moderate amount of hyperkeratosis and irregular acanthosis (fig. 4). There was no edema of the epidermis or cutis. The hair follicles, sweat and sebaceous glands were normal. A rather sparse lymphocytic infiltrate was present in the upper cutis, mostly around the blood vessels. The blood vessel walls were normal. In the hema-



3. Doughy thickening of skin and accentuation of normal skin markings. Dark area is biopsy site which healed poorly.

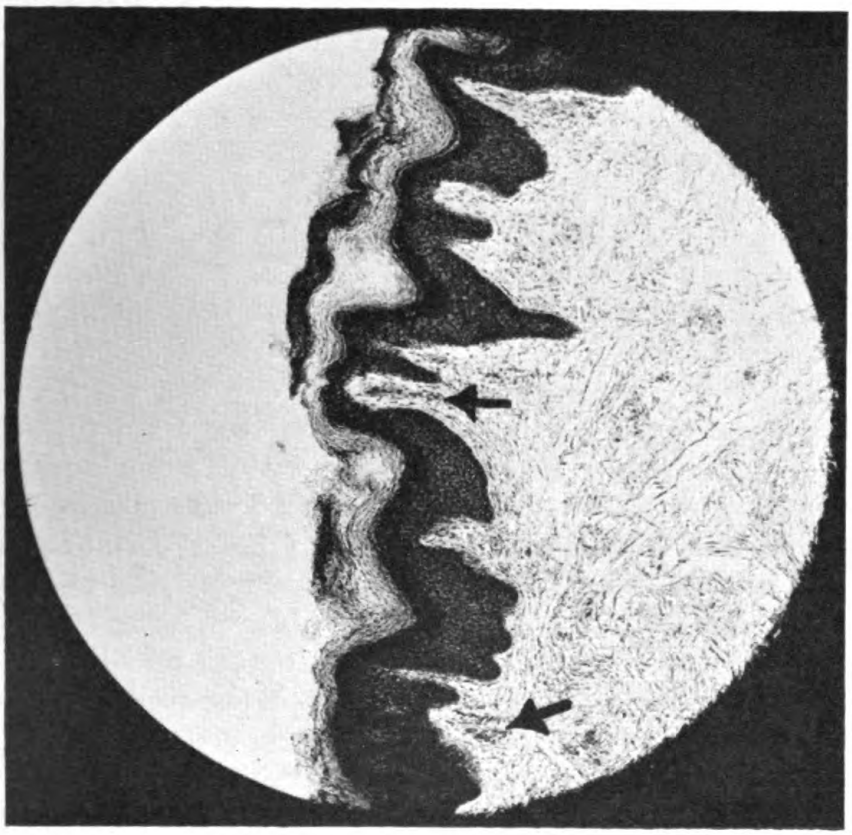
toxylin and eosin sections some of the collagen fibers showed a little basophilic degeneration. However, they had not taken on the homogeneous appearance which has been described in more advanced cases. Frozen sections stained with sudan III showed mantles of bright orange-staining material about many of the superficial blood vesesls. This material corresponded to empty spaces seen in the regular sections, the only discrepancy being that the spaces were much more numerous than were the deposits of orange-staining material. While some of them may have represented areas in which the lipoid material had been dissolved by alcohol in preparation of the regular sections, most of them were probably artefacts. The lipoid stained the color ordinary fat should stain. However, it was present in areas in which fat is normally absent. In the cutis a few of the collagen fibers stained very slightly with sudan III, indicating a minimal deposition of lipoid material.

COMMENT

These histologic findings fit in well with the usually reported histology of lipoid proteinosis. Previous reports have stressed the appearance of deposits of a lipoid-protein material about the blood vessels of the cutis, and on and between the collagen bundles which

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assume a hyaline picture. In nearly every report, the sections in which alcohol has been used showed empty spaces where much of the lipoid had been dissolved. The collagen bundles affected take on an abnormal color, dirty yellow-gray, with van Gieson's stain, according to Montgomery and Havens (*6*); yellowish to brown, according to Tripp (*7*), and stain a dirty orange-red color with sudan III. This material found in lipoid protenosis stains with fat stains, but not as brightly as with sudan III.



4. Sudan III stain.—Note hyperkeratosis, acanthosis, and the small deposit of lipoid material (arrow).

It was not possible to carry out any histochemical studies in this case. However, previous studies have shown that this lipoid material differs from the material found in ordinary xanthoma in many important respects (table 1). The material in lipoid proteinosis is soluble both in hot alcohol and in boiling acetone. The material found in ordinary xanthoma is soluble in the former but not in the latter. However, the lipoid proteinosis substance is not completely soluble in either solution and this has led observers to believe that it must be bound in some way to the proteins present. Hence the designation lipoid proteinosis. The lipoid is believed to be an acetone soluble phosphatid.

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TABLE 1.—*Comparison of lipoid material in lipoid proteinosis and xanthoma*

Lipoid proteinosis	Xanthoma
Not doubly refractile	Doubly refractile.
Digonin test for cholesterol—*negative*	Digonin test—*positive*.
Sudan III stains but usually less brilliantly than normal fat	Sudan III stains brilliantly.
Soluble in boiling acetone	Not soluble in boiling acetone.
Soluble in hot alcohol	Soluble in hot alcohol.
Smith-Dietrich test (a specific stain for phosphatid lipids)—*Positive*.	Smith-Dietrich test—*negative*.
No foam cells	Foam cells present.

Blood and tissue lipoid studies.—Studies of blood lipoids in other cases indicate that sometimes, but not always, abnormalities exist. These would be expected in the phosphatid portion. Ramos e Silva (*2*) lists the findings in various cases. The results are not at all consistent. In some cases there was an increase in total lipoids but no increase in lecithin. In others the lecithin was greatly increased. Determination of the lecithin content of the skin itself in several cases has shown a decided increase over normal. This was especially true in Ramos e Silva's case. Apparently there is a general as well as a local tissue lipoid disturbance.

The ulcer on the tongue in the present case which was apparently due to a nutritional disturbance of the tissues from the massive infiltrate plus secondary infection, healed within a few weeks under a regime of sulfathiazole chewing gum and local applications of a 2-percent butyn solution for the relief of pain. Because Tripp's patient, a latent diabetic, had improved considerably on insulin, this patient was given 5 units of insulin twice daily even though she was not diabetic. This dosage was gradually increased to 10 units. She gained weight, felt much better, and her choking spells decreased in frequency. Her voice improved markedly. She stated that her tongue and lips felt definitely less rigid. However, in spite of the marked improvement in her general condition, no objective change in the lips, tongue or skin lesions was apparent after 4 months.

Treatment of this disease has in general been rather unsuccessful. Aside from Tripp's report of very successful results with insulin, therapy has had essentially no results. His patient had severe skin lesions on the face which soon became fewer in number and finally disappeared. The voice likewise increased considerably in volume.

All forms of local therapy, x-ray and radium, have been uniformly reported as of no value. It has been stated that some cases have improved after the patient became pregnant. However because of the considerable percentage of offspring who might be affected, pregnancy might not be advisable.

SUMMARY

Another is added to the instances of occurrence of the rare disease, lipoid proteinosis, recorded in the literature. The amazing simi-

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larity of the manifestations in this case to those of previously described cases is noted. It is believed that there may be many individuals suffering from this disease in whom the correct diagnosis would be made were this condition more widely known.

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ACTINIC MACULAR RETINAL PIGMENT DEGENERATION

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During the formative period of putting into operation an ophthalmologic clinic on a tropical island in the South Pacific there was occasion to examine many patients who had been in the tropics from 4 to 18 months. These patients for the most part had somewhat similar complaints and presented a rather characteristic ophthalmoscopic picture of the macula. The condition was seen in 150 cases, and because of its frequency warrants reporting at this time. A few representative cases are presented in tabular form.

The only procedures available for an ophthalmologic examination at the time were: (a) Visual acuity determination at 20 feet, with a standard adequately illuminated Snellen chart; (b) a homatropine hydrobromide refraction consisting of the retinoscopy, the subjective test, and the postcycloplegic examination 1 week later; and (c) an ophthalmoscopic examination while the eyes were under the influence of the cycloplegic.

The patients were examined as adequately as possible with the described available procedures, and the findings as put forth in this article are presented because of their possible significance at this time, but not, however, without the full realization that the exigencies of

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war in many ways prevented a thorough ophthalmologic and medical examination. Further detailed studies are being undertaken at the time of this writing.

The cases as presented here are in no way given consideration from a statistical point of view, but rather to present the significant symptoms, refractive error, visual acuity status, and the objective ophthalmoscopic findings.

The patients who presented themselves for examination were young, active, well-built, healthy white males. They each had a rather characteristic and similar theme to their symptomatic history which could well be summarized as follows: After having been in the tropics for about 6 months, they noticed that discriminative vision, both distant and near, had become blurred in comparison to what it had been when they first arrived here. To quote some of the patients: "I just haven't been able to see sharp outlines for the past few weeks." "The targets on the range have recently become blurred." "I can't read as readily as I could a few months ago." "My vision is definitely worse than when I arrived here."

Such rather definite statements were usually accompanied by other asthenopic symptoms which varied from day to day. These complaints were described as headaches, mild ocular pain, burning sensation in the eyes, and fatigue.

TABLE 1.—*Case data*

Case	Rate	Age	Service	Vision without glasses		Corrected vision		Health record vision		Date
				O. D.	O. S.	O. D.	O. S.	O. D.	O. S.	
1	S1c	22	USN, C. B.	20/25	$20/20^{-1}$	20/25	$20/20^{-1}$	20/20	$20/20^{-1}$	7-11-42
2	MoM1c	34	USN	20/25	20/25	$20/20^{-}$	$20/20^{-}$	.....	.....	.....
3	CM3c	23	USN, C. B.	20/25	20/30	$20/20^{-1}$	$20/20^{-2}$	.....	.....	.....
4	Pfc	21	USMC	$20/30^{-1}$	$20/30^{-1}$	20/30	20/30	.....	.....	.....
5	Sgt	30	USMC	20/25	20/25	$20/25^{+3}$	$20/25^{+2}$	20/20	20/20	12-29-41
6	HA1c	25	USNR	$20/25^{+3}$	$20/20^{-3}$	$20/20^{-3}$	$20/20^{-3}$	.....	.....	.....
7	Pvt	21	USMC	20/25	20/25	20/25	20/25	20/20	20/20	6-24-41
8	Pvt	22	USMC	20/40	20/30	20/30	20/30	20/20	20/20	8-17-40
9	F1c	....	USN	20/30	20/30	$20/20^{-3}$	$20/20^{-3}$	.....	.....	.....
10	MM2c	23	USN, C. B.	$20/30^{-1}$	$20/25^{-2}$	$20/25^{-1}$	$20/25^{-2}$	20/20	20/20	4-2-42
11	Pvt	18	USMC	20/25	20/25	$20/20^{-1}$	$20/20^{-1}$	.....	.....	.....
12	CCM	43	USN, C. B.	$20/50^{+3}$	20/50	20/25	20/25	20/20	20/20	5-16-42
13	Cpl	28	USMC	$20/25^{-2}$	$20/25^{-2}$	$20/20^{-1}$	$20/20^{-1}$	20/20	20/20	6-28-41
14	CM2c	34	USN	$20/20^{-2}$	20/25	$20/20^{-3}$	$20/20^{-3}$	20/20	20/20	11-23-42

The pertinent facts as presented in table 1 reveal some interesting features which are common to most of the patients. The first and

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probably the most significant of these is that the duties of all of these men necessitated their working outside in the bright sunlight day after day. Secondly, these men, with one exception, did not wear glasses—either regular or dark lenses. Thirdly, the notable absence of inside workers such as night details, yeomen, and pharmacist's mates appears to emphasize the significance of the outdoor feature of the pathologic cases.

The findings, as were the symptoms, were rather constant in all cases, permitting the condition to be described in general, with only two case reports added to complete the information in detail, in so far as the studies were carried.

FINDINGS

The vision was usually a poor 20/20 to 20/30 and reduced further to 20/25 through 20/70 when the vision was taken after placing a pinhole disk in front of the eye being examined. The refractive errors for the most part were small and of no visual consequence as was shown by the lack of visual improvement in the subjective acceptance examination of the refraction.

The external examination was normal in every instance except one in which there was a mild blepharitis. The conjunctiva in most

TABLE 1.—*Case data*

Service in tropics	Degree of macular change	Glasses worn	Duties while in the tropics	Subjective acceptance of retinoscopy
8 months	++ O. U.	No	Construction work	O. D. S+0.75=C+0.75×105. O. S. S+0.12=C+0.75×75.
4 months	++ O. U.	No	Small boat engineer	O. D. S+1.00=C+0.25×120. O. S. S+1.00=C+0.25×45.
7 months	++ O. U.	No	Outside carpentry	O. D. S+0.50=C+0.50×100. O. S. S+0.75=C+0.25×80.
5 months	+++ O. U.	No	Guard duty outside	O. D. S−0.50=C+0.50×155. O. S. S−0.50=C+0.50×5.
10 months	+++ O. U.	No	Telephone line work	O. D. S+0.25=C+0.25×95. O. S. S —=C+0.37×65.
7 months	++ O. U.	No	Outside detail	O. D. S−0.25=C+0.50×90. O. S. S —=C+0.25×90.
do	+++ O. U.	No	Machine gunner	O. D. S+0.50. O. S. S+0.50.
8 months	+++ O. U.	No	Tractor operator	O. D. S+1.50=C+0.50×80. O. S. S+1.25=C+0.25×70.
do	++	No	Operates bulldozer	O. D. S+0.25=C+0.25×125. O. S. S+0.50.
9 months	+++	No	Outside work	O. D. S−0.25=C+0.75×5. O. S. S−0.25=C+0.50×15.
6 months	+++	No	do	O. D. S+0.25=C+0.25×93. O. S. S+0.25=C+0.25×58.
9 months	+++	Rarely	do	O. D. S−0.75=C+0.75×55. O. S. S−1.00=C+1.25×85.
5 months	+++	At times	do	O. D. S —=C+1.25×93. O. S. S+0.25=C+1.25×90.
do	+++	Clear, yes	do	O. D. S+1.00. O. S. S+1.00.

cases showed a slight injection of the exposed area. In two cases there was a mild circumcorneal injection of the episcleral vessels. The

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cornea, anterior chamber, iris, pupil and its reactions, lens, and the media were normal in each instance.

The fundus examination revealed a rather constant and typical pigmentary disturbance in the macula which varied but slightly in degree in each eye of a patient. There was a faint but definite edema of the macular and paramacular retinal tissues which gradually faded into normal retinal tissue. The total edematous area involved was about two-thirds the size of the optic disc. The bright light reflex from the fovea was replaced by a dispersed light reflex which resembled a honeycomb cell structure.

The pigment epithelium of the macula presented rather marked changes from its usual uniform appearance, and while these changes were not characterized by their degree, but rather by the rearrangement of the pigment pattern, it was possible to distinguish three different patterns.

The most frequent picture seen was one wherein the pigment presented itself in discrete sharply defined granules with a pink reflection from the choroid in the depigmented adjacent space which by contrast appeared as a pseudo halo.

In the second pattern the increased pigmented tissue was arranged in a linear form, radiating spoke-like from the fovea.

The third and least common picture was one in which there was a proliferated heterogeneous rearrangement of the pigment in the macula which presented no definite pattern but was marked by areas of lesser or greater pigment accumulation.

These pigmentary disturbances were in all instances confined to an area well within the limits of edema in the macula.

CASE REPORTS

Case 5.—A sergeant, USMC, age 30 years, complained of blurred distant and near vision, headaches, and asthenopic symptoms. During the past few months there has been a definite decrease in critical vision. His headaches were frontal in location and accompanied by a burning sensation in his eyes. The patient wore "near glasses only" for a short time 4 years ago. His parents, brothers, and sisters all wear glasses but have good vision with their correction. There are no known eye diseases in the family. The patient has served as a lineman on a telephone system, working at all times in the bright sunlight and has had no lenses of any kind to wear.

The general physical examination was essentially negative.

Findings of importance during the eye examination were a fine edema of the macula and paramacular retinal tissues. The foveal reflex was absent and in its stead there was a diffuse honeycomb-like light reflection. There was a definite rearrangement of the pigment epithelium in the macula which was characterized by an accumulation and condensation of pigment granules radiating from the fovea. A fine pink reflection was seen distinctly between these pigment bands. The sum effect was similar to the spoke arrangement on a wagon wheel. These changes were manifest in an area about one third the area of the disc.

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Refraction findings were the following:

Net homatropine retinoscopy:

O. D. S.+0.50=C+0.25×95.

O. S. S._____ =C+0.50×90.

Subjective acceptance:

O. D. S.+0.25=C+0.25×95 20/25.

O. S. S._____ =C+0.37×65 20/25.

Corrected vision O. D. with a pinhole disk 20/50.

Corrected vision O. S. with a pinhole disk 20/70.

Case 8.—A private, USMC, age 22 years, complained of blurred distant and near vision and vague ocular complaints. His vision was definitely not as good as when he arrived at this station, and it had become increasingly blurred during the past month. He had headaches in the evening and noticed a feeling of ocular fatigue, accompanied by mild ocular pain. He had been driving a truck during the daytime almost all of the time. He had driven trucks with and without cabs but had more often used a truck with a cab. The patient had had no lenses of any kind to wear.

The eye examination revealed findings similar to those in the preceding case.

Refraction findings were:

Net homatropine retinoscopy:

O. D. S+0.50=C+0.25×80.

O. S. S+0.50.

Subjective acceptance:

O. D. S+0.50 20/25.

O. S. S+0.50 20/25.

Corrected vision with a pinhole disk:

O. D. 20/50.

O. S. 20/70.

DISCUSSION

The various tissues of the eye are known to respond in rather characteristic ways to the three main components of the solar spectrum; namely, the infra-red rays, the visible rays, and the ultraviolet and other shorter rays. The short end of the spectrum produces the so-called abiotic effects which are seen in the cornea, lens, and inner retinal layers; whereas the long rays—infra-red—produce a thermal effect upon the cornea, lens, and retina. Such thermal lesions in the retina result from the absorption of heat by the pigment epithelium and produce destructive lesions which spread both forward into the retina and backwards into the choroid.[1]

SUMMARY

A rather characteristic ocular syndrome was seen in patients who had been in the tropics for a period of four months or more, and the significant features are presented as follows:

1. A gradual but slight decrease in visual acuity.
2. Constant and typical macular retinal pigment changes.
3. All cases seen were in outside workers.
4. The notable and conspicuous absence of the condition in indoor workers such as yeomen and pharmacist's mates.

[1] Duke-Elder, Sir W. S.: Textbook of Ophthalmology. The C. V. Mosby Co., St. Louis, Mo., 1939. pp. 825–831.

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CONCLUSIONS

It is probable that the prolonged and unprotected exposure to the infra-red rays of the solar spectrum in the tropics produces changes in the pigment epithelium of the retina which are represented in their early stages by these cases. In some respects these lesions are similar to the pathologic picture seen in the early stages of senile macula degeneration.

Even though the subjective and objective findings in these cases appear to be slight at this time, it is felt that continued exposure may possibly result in serious and permanent damage to the ocular tissues.

In view of the potential hazard to vision for many men in service, the observed pathologic pictures are published at this time to stimulate further observation and study.

SKIN SENSITIZATION PRODUCED BY LOCAL APPLICATION OF SULFONAMIDES

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Many pyogenic skin infections have responded well to local application of the sulfonamide drugs. This has been particularly true in the case of crystalline sulfanilamide and sulfathiazole ointment as used in impetigo, folliculitis, ecthyma, impetiginous dermatitis and similar pyodermas. The striking successes which have been reported have so popularized this method of treatment that physicians have been led to put sulfa compounds on any form of skin lesion. This is not without considerable risk to certain patients.

Apparently enough of these drugs are absorbed from an open lesion to sensitize some patients either to further local application or to subsequent oral administration. In either case when sensitization is complete, there develops explosively a generalized dermatitis which not only is extremely disabling and may necessitate hospitalization, but also often leads to secondary infection and serious complications. Furthermore, the sensitization may last for a long period, possibly for a lifetime, and prevent the use of the sulfonamide drugs at a time when their lifesaving powers are most urgently needed. The following case reports are presented to illustrate the dangers of indiscriminate or prolonged local application of sulfonamide compounds.

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CASE REPORTS

Case 1.—A 28-year-old fireman, first class, developed a dry scaling circinate patch of fungus infection on the dorsum of his right foot and the heel of his left foot. In spite of the use of numerous fungicidal remedies, the infection spread during the next 4 months to involve the entire dorsum of both feet and the whole circumference of both ankles. At the end of that time sulfathiazole ointment was applied to his legs daily. After 4 days a maculopapular eruption was noticed on the arms. Sulfathiazole was continued for 2 more days. The lesions on the arms then became vesicular and weeping and the maculopapular rash spread to the chest and back. Pruritus was extreme. An attempt was made to alleviate the pruritus with compresses of a solution containing phenol, compound tincture of benzoin, glycerin, and alcohol. A few minutes after this was applied, the patient became semicomatose and almost pulseless. He was given plasma intravenously and washed off with quantities of alcohol. He was soon fully conscious and out of shock. For the next 3 weeks he was treated with calamine lotion and starch baths. Improvement, with lessening of pruritus and drying of the lesions was steady but gradual.

Approximately 1 month after the first application of sulfathiazole ointment he was accidentally given 1 gm. of sulfathiazole by mouth. Three hours later he was in distress from a return of the very severe pruritus, his whole body was intensely erythematous and in 6 hours a generalized maculopapular eruption was superimposed upon his healing scaling dermatitis. In spite of almost continuous starch baths, dressings of cottonseed oil and calamine lotion, he got no rest for the next 36 hours without the use of morphine hypodermically. At the end of 1 week the fresh eruption had subsided and he presented the picture of a generalized exfoliative dermatitis in the same stage of healing as was present before the sulfathiazole was taken. At this point he was evacuated to another hospital.

Case 2.—An 18-year-old Marine, private first class, developed signs of secondary infection between the toes of his right foot at the site of maceration from fungus infection. He was treated with potassium permanganate soaks, removal of crusts and application of sulfanilamide powder. After 30 days of this treatment he broke out with a generalized papular rash involving face, trunk, arms and legs, hands and feet. The following day the eruption had become pustular, and erythematous lesions appeared on the buccal mucous membrane. The same treatment of potassium permanganate compresses was continued but sulfanilamide was omitted. The erythema and papules disappeared in a few days, but several of the pustules became ecthymatous and very persistent. The condition of the foot never varied.

Three weeks after the pustular outbreak, a thrombosis of the left brachial vein was found. This was proximal to 3 ecthymatous lesions about the left elbow. Some localized areas of cellulitis appeared near the involved vein. During the following 10 days, on conservative treatment with Epsom-salt compresses to the arm and potassium permanganate compresses to the foot and ecthymatous lesions, all the lesions cleared up.

Case 3.—A 26-year old fireman, first class, reported for treatment of a vesiculosquamous eruption of the left thumb. This spread to the dorsum of the hand in spite of calamine lotion. For a week the lesion was dusted with sulfonamide powder. However, there was no improvement and the entire dorsum of the left hand from wrist to metacarpophalangeal joints became involved. For 9 days compresses of potassium permanganate were applied. Three weeks later there was no change in the lesion so a sulfathiazole ointment dressing was

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used. Four days of the treatment was followed by the rapid appearance of a generalized maculopapular eruption. This moderately pruritic morbilliform eruption was very marked on face and trunk, arms and legs, palms, and soles. It was treated with starch baths, calamine lotion, and sodium thiosulfate ½ to 1 gm. intravenously every second day. The rash was much paler at the end of a week, less papular, and beginning to desquamate. The lesions on the forearms continued red and oozed moderately. During the second and third week healing progressed favorably and the original eruption on the back of the hand was dry and little different from the rest of the body. By the end of the fourth week the skin had practically returned to normal.

Case 4.—A 22-year-old Marine private sustained a small burn of his left thumb. The area became superficially infected and was treated daily with sulfa crystals and dressed. At the end of a month the lesion had healed and treatment was stopped. A month later he reported for treatment of three pustules on the back of his neck. For 4 days he was treated with sulfathiazole and cod liver oil ointment. The skin of the neck became more irritated and red, and more pustules, erythema and impetiginous crusts appeared. Treatment was changed to hot water compresses and calamine lotion. After a week of this the entire back of the neck was covered with an impetiginous folliculitis, and the posterior cervical glands were all swollen and tender. He was put on constant saline compresses, all crusts removed twice daily and the neck dusted with sulfanilamide crystals. He began at once to improve. The neck looked cleaner but the lymphadenopathy was unchanged. After 6 days of apparent tolerance to sulfanilamide powder locally, sulfathiazole was administered orally. Three hours after the first dose of 2 gm. was given, acute malaise and pruritus commenced. Six hours after the drug had been ingested the patient was covered completely with a maculopapular rash, most marked on face and trunk, arms and legs, palms, and soles. The neck, especially around the original lesion became very swollen and edematous, giving a "bull-neck" appearance. Under treatment with constant boric acid compresses to the neck and calamine lotion to the rest of the body the generalized eruption subsided. At the end of a week it had all disappeared. The neck was then treated conservatively with simple wet dressings and removal of crusts and after 6 weeks became entirely normal.

COMMENTS

In case 1, while the maculopapular eruption following 6 days of topical application of sulfonamides to a fungus lesion of the foot may have been a dermatophytid, the acute generalized eruption which occurred 3 hours after ingestion of 1 gm. of sulfathiazole by mouth was undoubtedly due to a marked sensitization to sulfathiazole.

Case 2 illustrates sensitization to sulfanilamide applied to dermatophytosis of 1 foot daily for 1 month, resulting in a generalized eruption which became pustular and led to many ecthymatous lesions and to venous thrombophlebitis in the left arm. These latter complications resulted in at least 30 days more hospitalization than would otherwise have been necessary to clear up the original fungus infection.

With case 3 it should be emphasized that while 4 days of sulfonamide ointment were at once followed by the characteristic morbilliform eruption due to drug toxicity, the patient had probably already become

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partially sensitized by 7 days' previous local treatment with sulfonamide powder. The general eruption in this case was severe and fixed enough to be a hospital problem 3 weeks after onset.

The last case shows how the use of sulfonamide powder applied locally for a month for a minor skin infection plus 3 days of sulfathiazole ointment and 6 days of sulfanilamide powder to another pustular lesion 1 month later, was sufficient to cause an extraordinary explosive skin reaction 3 hours after taking 2 gm. of sulfathiazole by mouth. This eruption, however, cleared up inside of 1 week.

REGIONAL ENTERITIS IN THE NAVAL SERVICE

WITH REPORT OF CASES

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Diseases of the lower right quadrant of the abdomen constitute a high proportion of all admissions to this Naval hospital. The appendix is the most frequent source of trouble. Occasionally however, an unusual lesion such as regional enteritis is encountered, the early recognition and accurate treatment of which will shorten disability in many instances.

Regional enteritis is a nonspecific inflammation of the intestine, usually involving the terminal ileum, and characterized in its chronic stage by formation of an ulcerating, proliferating and cicatrizing granulomatous mass. The cause is unknown. It is most common during the second and third decades of life, the age group which includes the majority of naval personnel.

ACUTE STAGE.

The disease in its acute form is clinically similar to acute appendicitis. It may occur either as an initial attack or as an acute exacerbation of long-standing symptoms. Pain and tenderness in the right lower quadrant, fever, leukocytosis, and diarrhea are common. It is difficult to distinguish from appendicitis without laparotomy. At operation the intestine, usually the terminal few inches of the ileum, is swollen, and hose-like in consistency. It may be bright red or pink in color. Intense edema may be present. There is an enlargement of adjacent mesenteric lymph nodes. The appendix and cecum may appear normal or may share in the process. The following case illustrates the acute phase.

Case 1.—A 23-year-old private, USMC, was admitted to the surgical service because of crampy abdominal pain, nausea and vomiting of 2 days' duration.

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He had passed 15 watery stools in 12 hours. He related that several similar attacks had occurred during the past year.

The temperature was 101.6° F. The leukocyte count was 11,600, with 72 percent polymorphonuclear cells in the differential smear. There was localized rigidity, tenderness and rebound tenderness in the right lower part of the abdomen. Rectal examination was unrevealing. While the history was one of acute gastroenteritis, the findings were so suggestive of appendicitis that laparotomy was deemed advisable.

At operation the terminal 8 inches of the ileum was found to be markedly swollen, indurated, and purplish red in color, with large nodes in the ileal mesentery. The bowel above and below the indurated area appeared normal, as did the appendix. The latter was removed, however, and the wound closed without drainage. Convalescence was uncomplicated and x-ray studies 2 weeks later showed no pathologic changes in the terminal ileum. The patient was discharged to duty on the twenty-fourth postoperative day with no complaints.

This case is typical of several which we have seen on this surgical service during the past year. Whether or not some of these will progress to the chronic granulomatous state is as yet uncertain. Exploration is usually necessary, preferably without appendectomy because of the danger of postoperative fistula formation. This should be followed by a bland diet, and sulfonamide and vitamin therapy. X-ray studies at intervals over a long period are advisable.

SUBACUTE AND CHRONIC STAGES.

Patients with subacute or chronic regional enteritis usually have a long history of crampy abdominal pain, most severe after meals. Low-grade fever, loss of weight, moderate anemia, hypoproteinemia and vitamin deficiency are common. Often there is an intermittent diarrhea, with mucus and sometimes blood in the stools. Fistulae to the abdominal wall or to the perineum may be present. Frequently there is a tender, ill-defined mass in the lower right abdomen. X-ray studies of the involved intestine may show narrowing of the lumen with rigidity of the wall and an absence of mucosal markings. The bowel proximal to the diseased area may be dilated. The disease must be differentiated from appendicitis, appendiceal abscess, ileocecal tuberculosis, neoplasm, and mesenteric adenitis.

Direct examination of the bowel in the subacute and chronic stages of this disease shows a peculiar granulomatous change. It most often extends upward from the ileocecal valve, but may continue into the cecum and colon or may occur anywhere in the intestinal tract. So-called "skip areas" separated by normal bowel may be present. In the involved areas there is dense thickening and infiltration of the submucosa, muscularis and serosa, with narrowing of the lumen. The mucosa often shows multiple ulcerations. Usually there are enlarged softened lymph nodes in the mesentery adjacent to the diseased areas. There may be perforation into other viscera, the abdominal

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wall or perineum. The following case is typical of the chronic stage of this disease.

Case 2.—A 27-year-old machinist's mate was admitted to the surgical service complaining of crampy abdominal pain and diarrhea of 3 days' duration. He had had intermittent attacks of a similar nature for 7 years, the crampy pain usually occurring after meals. There had been a 20-pound weight loss during the preceding 6 months. The temperature was 99.8° F. The hemoglobin was 99 percent, the erythrocytes 4,780,000, and leukocytes 18,800 with a differential containing 86 percent polymorphonuclears. There was acute tenderness and a questionable mass in the right iliac fossa. Rectal examination showed tenderness high on the right side, but no mass could be palpated. A tentative diagnosis of appendicitis with probable local perforation was made.

Through a McBurney muscle-splitting incision the abdomen was opened. The great omentum was found to be firmly adherent to the anterior surface of the cecum, appendix, and terminal ileum. The appendix was mobilized and removed with difficulty, after which it was recognized that the cecum and terminal ileum formed a large single inflammatory mass. The abdomen was closed without further exploration. Microscopic examination of the appendix showed marked lymphoid hyperplasia and a few leukocytes scattered through the wall.

Convalescence was complicated by a wound sinus, draining seropurulent exudate. The mass persisted as did the crampy abdominal pain. Results of subsequent tuberculin, Wassermann, and Frei tests were all negative as were those of stool examinations and x-rays of the chest. Five weeks after operation an x-ray series of the ileocecal region was carried out, serial fluoroscopic and spot films being made 2, 3, and 5 hours after ingestion of barium. Changes characteristic of advanced regional ileocolitis were found. There was a marked rigidity, distortion, and narrowing of the terminal few inches of the ileum, the changes extending into the medial aspect of the cecum. Two internal fistulae were noted extending from this region, one to the proximal part of the transverse colon and the other into an adjacent loop of small intestine.

Five days later the abdomen was reopened through a left paramedian incision. Findings were essentially those noted by x-ray. The distal 6 inches of the ileum and the cecum were fused into a large mass. Twenty-four inches proximal to this was a "skip area" 1 inch in length. Twenty inches above this was another "skip area" firmly attached to the ileocecal mass and the site of the ileo-ileal fistula previously seen in the x-ray. The remainder of the small bowel was normal. There was a firm attachment between the cecum and proximal part of the transverse colon, the site of a colo-colic fistula. The ileum was divided about 18 inches proximal to the highest ileal involvement, and an end-to-side ileo-transverse colostomy was performed.

Following this short-circuiting procedure, the patient showed slight improvement. The sinus in the appendectomy wound closed and the crampy abdominal pain disappeared. X-ray examination 1 month later, however, showed no change in the diseased bowel, and persistence of internal fistulae.

Five weeks later, through a right transverse incision, the ileum distal to the transection, the right colon and proximal part of the transverse colon were resected. The specimen is shown in figures 1 and 2.

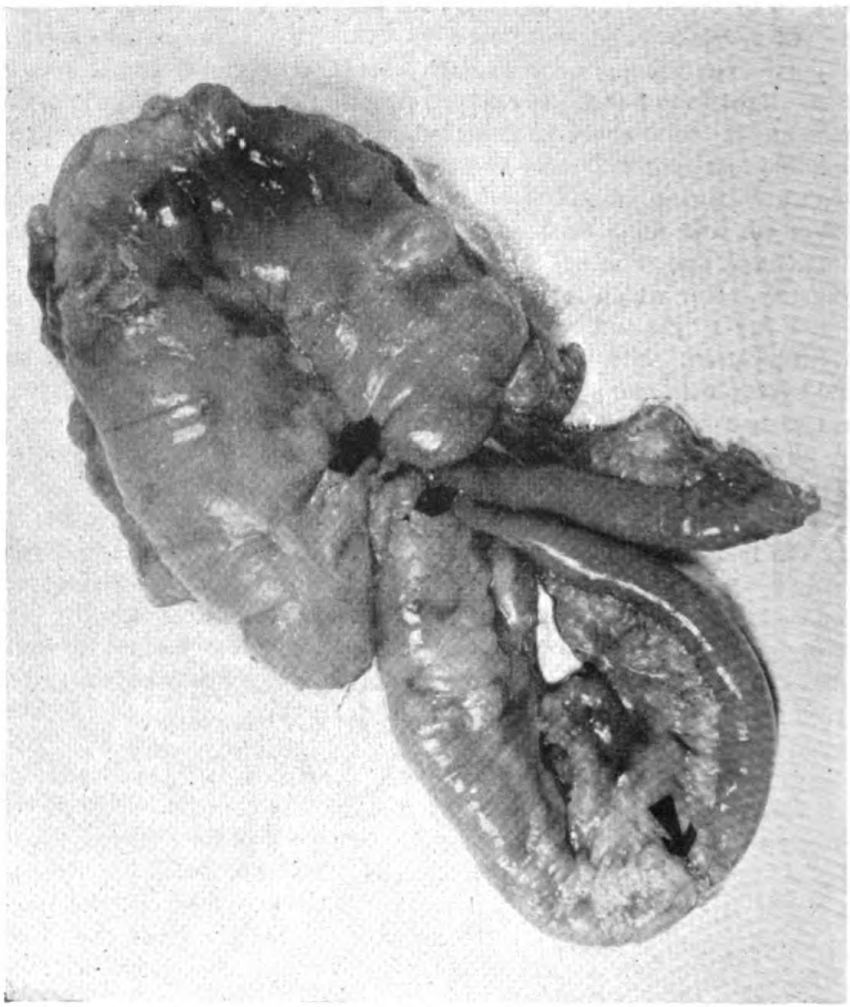
The pathologic findings were as previously noted. In addition, there was considerable edema and lymph node enlargement in the ileal mesentery. Sections of involved bowel showed the usual changes of nonspecific regional enteritis.

Convalescence was uneventful. The patient has gained in weight and strength and has good digestion without pain. He has returned to duty.

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This case illustrates an advanced stage of regional enteritis, with extensive granulomatous changes and the formation of internal fistulae. Such advanced cases will occasionally be encountered in naval personnel. Treatment is surgical. Some patients will become quiescent or possibly cured by a short-circuiting procedure with defunctioning



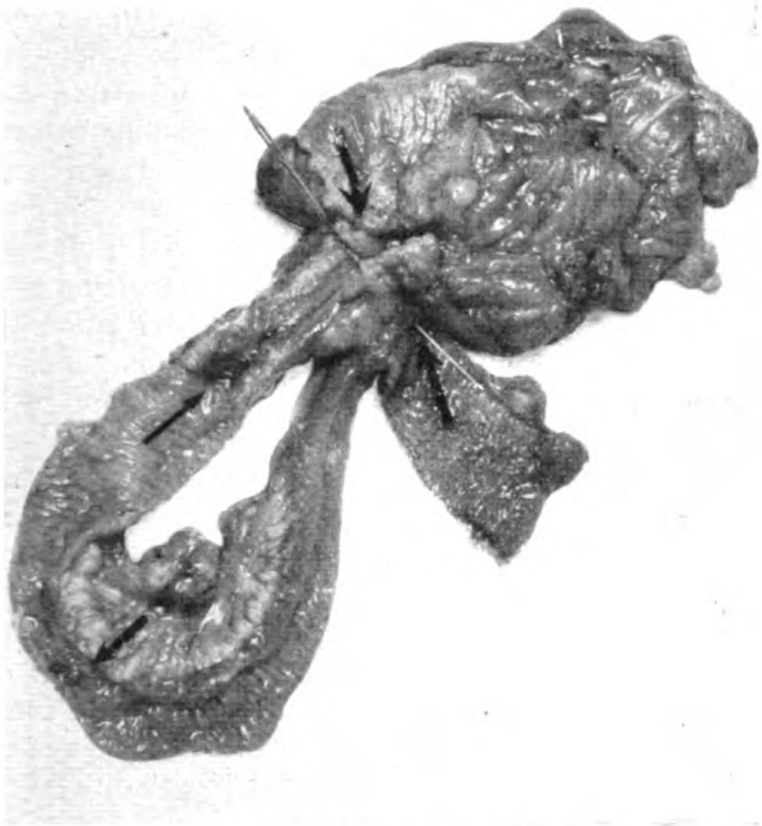
1. The specimen from case 2 included about four feet of ileum, the cecum, ascending colon and part of the transverse colon. The arrows, reading from above downward, indicate the colo-colic fistula, ileo-ileal fistula and a "skip area" in the ileum. Note the thickening and edema of the ileal mesentery.

of the diseased bowel. Others will require resection, in one or multiple stages. One advantage of a multiple-stage procedure is the opportunity to observe the effect of defunctioning the diseased intestine. This treatment may be sufficient. If resection is undertaken, it should be done radically so as to include all diseased bowel and as much of the involved mesentery as possible. Even with this radical treatment recurrences are occasionally noted.

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SUMMARY

The possibility of regional enteritis must be considered in treating Naval personnel with abdominal complaints. The acute type is difficult to distinguish from acute appendicitis before laparotomy. Once



2. The opened specimen from case 2. Note the granuloma involving the ileum and cecum, narrowing of the terminal ileum, the large ulcer, the two "skip areas" and the ileo-ileal fistula from the upper one.

diagnosed the treatment is primarily medical. The subacute and chronic types usually require surgery. A defunctioning procedure may be sufficient, but some will need resection.

MECHANICAL EXTERNAL FIXATION OF THE HIP JOINT

SIDNEY SIDEMAN
Lieutenant Commander (MC) U. S. N. R.
and
HARRY BARNETT
Captain (MC) A. U. S.

Treatment of an adult afflicted with tuberculosis of the hip joint has always been difficult. In civilian practice, in addition to the diseased hip joint, the serious economic handicap, the long period of

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hospitalization, and the complete physical invalidism of the patient must be considered. These are also psychologic barriers to healing.

Treatment of the hip joint consists in providing joint rest, either by long periods of plaster-cast fixation, by traction, by surgical fusion, or by a combination of these three types of immobilization.

Surgical fusions, whether by means of extra- or intra-articular or combined arthrodesing operations, result in a high percentage of failures in the adult hip joint. Postoperative immobilization in plaster casts or traction is essential until bony fusion has taken place.

Skin care, draining sinuses, and surgical wounds present a daily dressing problem made more difficult by plaster-cast immobilization. Fixation of the knee, ankle and foot joints is always more complete than is that of the diseased hip joint. Prolonged hip-spica cast immobilization often leaves a joint remarkably free from stiffness.

Due to these discouraging factors in immobilization therapy of tuberculosis of the hip joint in adults, a method of mechanical external fixation which would adequately immobilize the joint has been attempted. The method presented may be an aid in the treatment of war casualties where hip joint immobilization in plaster casts is impossible due to lack of plaster, or undesirable because of necessity for transportation, or where it is necessary to have the wounded become ambulatory as soon as possible.

A pelvic femoral fixation was obtained which enabled the patient to turn in bed, walk with crutches, and exercise all extremity joints except the hip joint. Dressings were easily applied to the surgical wound and draining sinuses. Skin care was simplified and the texture of the skin quickly returned to normal. Muscle atrophy subsided and healing progressed rapidly because of the beneficial effect of activity on circulation. Psychologically the improvement was remarkable.

CASE REPORT

The patient, 34 years of age, was first seen on 16 October 1938, complaining of pain and severe muscle spasms of the right hip and knee of 2 months' duration. Physical examination and roentgenographic study revealed an active tuberculosis of the right hip joint.

Traction was applied and supportive treatment carried out until the patient's general condition was considered to be excellent. Three months later an arthrodesis of the hip joint was performed, using Chandler's extra- and intra-articular arthrodesis technic. Specimens of tissue were obtained for microscopic and guinea-pig study and the diagnosis of tuberculosis was confirmed.

Postoperative immobilization consisted of the application of a bilateral hip-spica cast which included both feet. Drainage from the surgical wound and infection with disintegration of the trochanteric graft ensued. A second attempt at hip joint fusion was made 6 months later and postoperative hip-spica cast immobilization was used. This arthrodesis also failed to produce fusion. Profuse purulent wound drainage and infection of the graft and upper one-third of the femur developed.

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The following month the graft was removed, the hip joint and upper femur were curetted, and open-wound vaseline-pack treatment for osteomyelitis was instituted. Immobilization was by hip-spica cast which was changed repeatedly for the next 4 months. At the end of that time there were two profusely draining sinuses in the surgical scars. No suggestion of healing of the tuberculosis of the hip joint and osteomyelitis of the femur was apparent clinically or roentgenologically. Fever had been a daily symptom for nearly 20 months and the patient's general health was only fair. He was placed in a bivalved hip-spica cast and discharged home, where he remained bedfast.

A visiting nurse changed the dressings by manipulating the bivalve cast. Drainage increased and a third sinus developed. A new cast was applied in the outpatient department as often as necessary. Roentgenograms revealed a gradual disintegration and sloughing of the head of the femur. The osteomyelitis of the upper femur persisted.

Six months after the patient's discharge from the hospital, a fourth sinus appeared, and the temperature rose to 104° F. He was admitted to the hospital and the cast was removed. Traction was applied and supportive measures were instituted. Four sinuses were active. Pain and deformity of the hip were supplemented by a stiff knee, ankle, and foot on the involved side. The skin was covered with a dermatitis, scales, ulcers, and sinuses. Muscles had undergone extreme atrophy through disuse and infection. Seventeen hip-spica casts had been applied since the patient was first seen.

The patient was kept in traction for 6 months after the last cast application and again there was no cessation of drainage, decrease of the afternoon fever, or diminished pain. Muscle atrophy and stiff joints were still present.

External fixation by means of a Roger Anderson universal fracture unit was applied and the patient immediately began to make remarkable progress. Pain and fever subsided and 3 of the 4 sinuses healed. One year later the remaining sinus was practically closed, the patient was ambulatory with the aid of crutches and his foot and ankle joint motion had returned to normal. The knee joint moved through a range of 30°, being limited chiefly by the supracondylar pins. The apparatus had remained in place without adjustments or pin seepage of any importance until 12 months from the time of application. When the apparatus was removed, 3 of the 4 pins were loose with a minimum of pin seepage.

Roentgenograms made immediately preceding the mechanical external fixation (fig. 1) and after 10 months (fig. 2) reveal definite healing of the tuberculosis, although bony fusion of the hip joint is not present. An excellent fibrous fixation has undoubtedly developed. Healing of the femoral osteomyelitic process is well advanced. The photographs shown in figure 3 were made 7 months after application of the splint.

TECHNIC OF APPLYING SPLINT

Local anesthesia consisting of 1-percent novocain is used at the pin sites. The pins, in this case inserted into the crest of the ilium, are one-sixteenth inch. They are guided so as to assure traversing the longest distance within the bone of the crest. Two pins are hand drilled into the crest, one starting above and the other below the anterior superior iliac spine, running diagonally through the crest and crossing at an angle of 15°. There is no danger of peritoneal penetion if the pins are inserted in an anterior-medial to a posterior-lateral direction.

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A pin clamp is placed on the end of each pin and a universal rod slipped through the two clamps and fastened. A third universal rod connects the two side rods for further stability of the crest unit. In



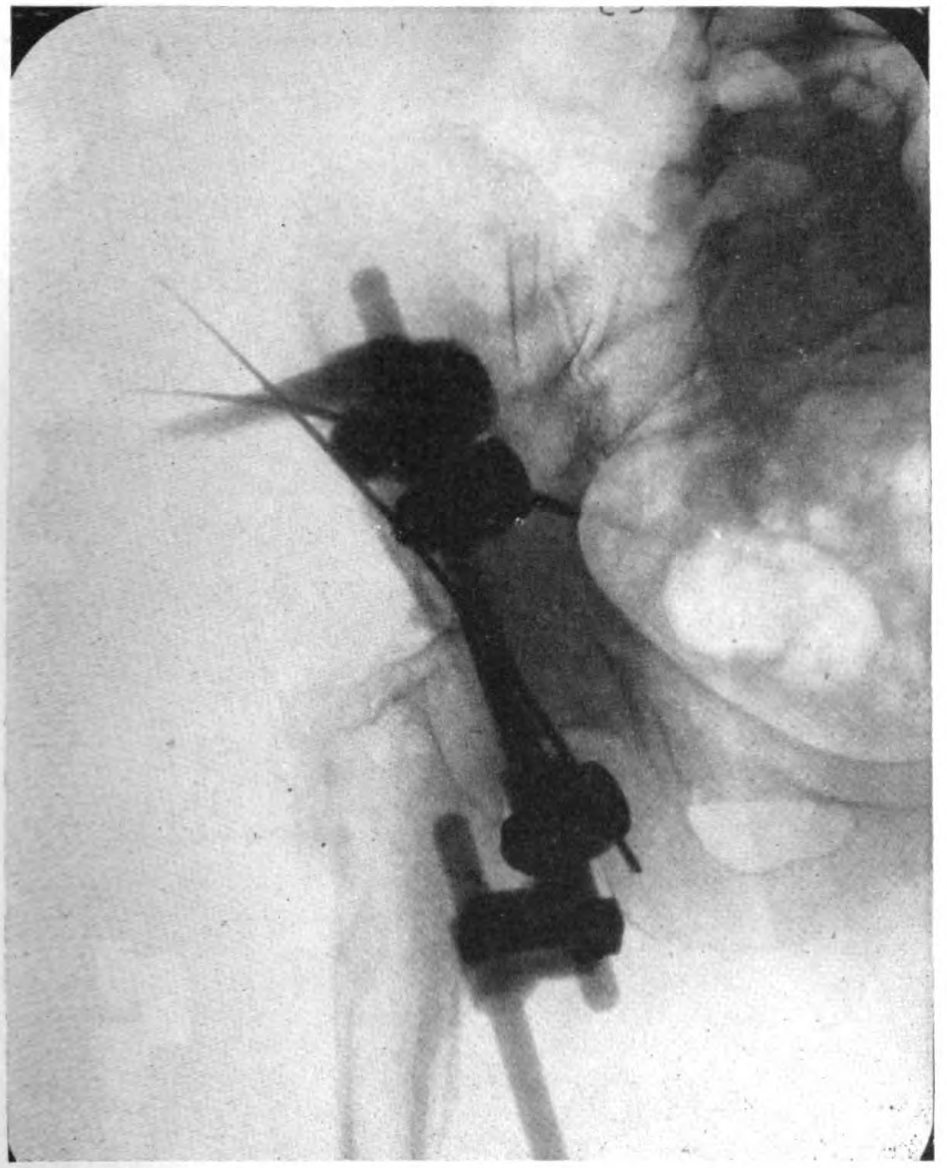
1. This view shows joint immediately preceding the mechanical external fixation.

the supracondylar region two ⅛-inch pins are hand drilled through the femur at angles in order to avoid parallel placement. Pin clamps and universal rods complete the femoral unit. The crest unit and the

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femur unit are connected with parallel universal rods to complete the pelvic femoral fixation (fig. 4).

This provides the mechanical external fixation, and immediately the pelvis is consolidated with the thigh. The pins are remote from



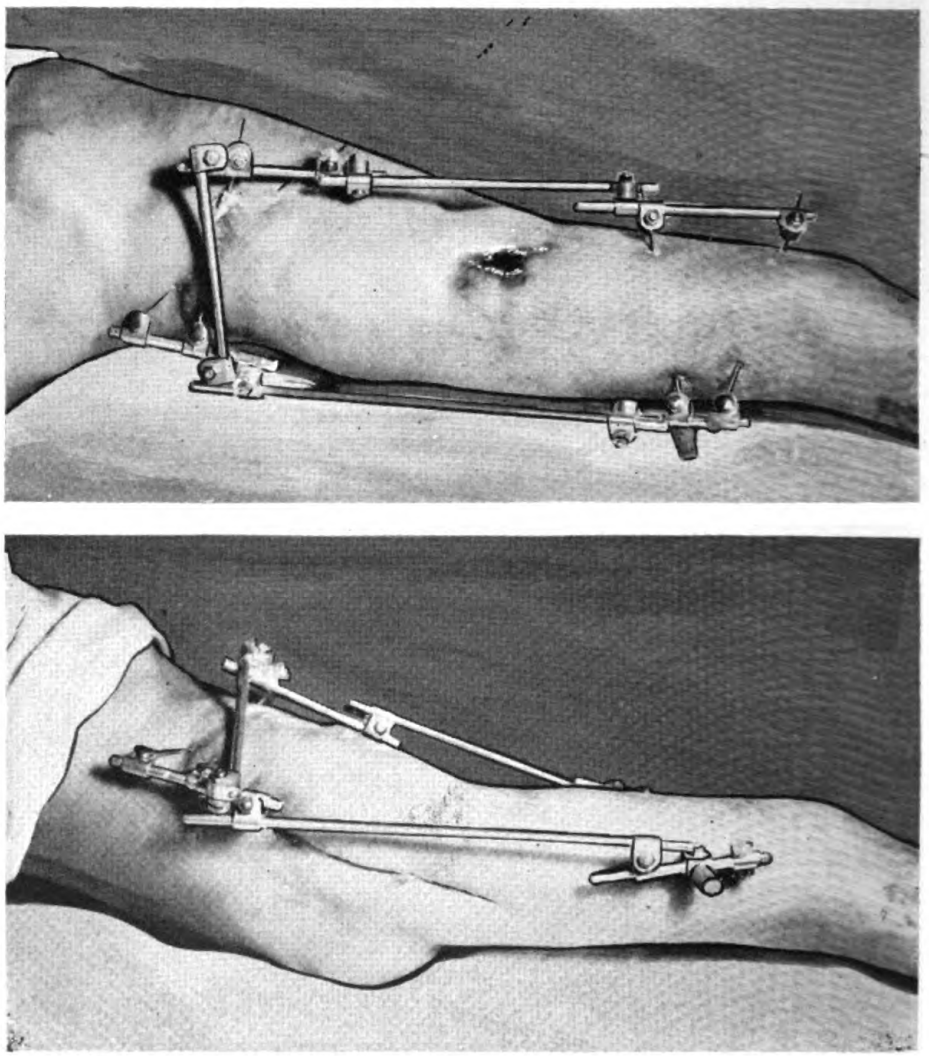
2. Ten months after fixation.

sinus tract discharges, so that dressing of the sinuses is easily carried out. Small dry dressings which are placed about the pins at the skin perforations are discontinued after 10 days.

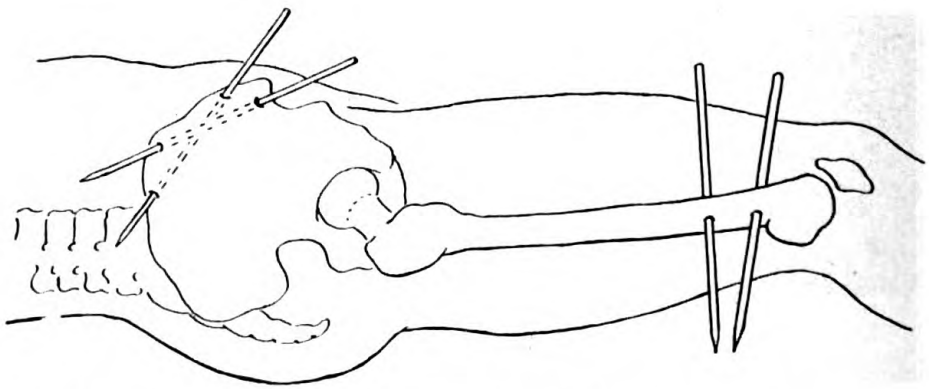
CONCLUSIONS

One case, occurring in an adult, of hip joint tuberculosis of 4½ years' duration which responded to external fixation is reported.

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3. After 7 months' continuous fixation.



4. Showing method of drilling pins through femur and crest of ilium.

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The length of time pins can remain in bone without danger has been demonstrated in this instance to be at least 12 months.

A large number of cases will have to be accumulated before mechanical external fixation can be advocated as the immobilization method of choice in tuberculosis of the hip joint. It is, however, recommended for external fixation of the hip joint in osteo-arthritis, in chronic osteomyelitis, and in war wounds, especially with loss of bone. It should be indicated whenever it becomes necessary to immobilize the hip joint for long periods of time.

MULTIPLE FRACTURES OF ARM AND FOREARM

REPORT OF A CASE

MERVYN SHOOR
Lieutenant (MC) U. S. N.

Multiple fractures involving simultaneously the humerus, the radius, and the ulna of the same extremity are relatively uncommon. A perusal of the literature for a 10-year period reveals only one similar reported case, although Thorndike and Dimmler[1] in 1941 reviewed 364 cases of fractures of the forearm and elbow in children. The following case exemplifies this unusual fracture.

CASE REPORT

An apprentice seaman, age 17 years, was injured while at sea. He had opened the lid of a rotary extractor in the laundry (speed 1,800 revolutions per minute), turned off the current, and placed his left hand on the head of the revolving drum to slow it down. In some manner his hand slipped and became caught in the whirling mass of clothes, imparting a sudden, rapid torsion of the entire left upper extremity. He experienced immediate pain and loss of function of the extremity, but was able to extricate his hand. The extremity was splinted in the sickbay and morphine and sodium pentobarbital were administered.

On inspection 2 hours later the patient appeared to be comfortable. The pulse was 90 and regular; blood pressure was 120/75. There was moderate swelling about 3 inches above the elbow, and crepitus and false motion in the area were easily elicited. There was obvious shortening of the arm. Upon palpation the impression was gained that there was a complete fracture of the lower third of the shaft of the humerus with upward lateral displacement of the distal fragment and lateral angulation.

Examination of the forearm showed an angular deformity in the middle third of the ulna, the proximal fragment being palpated superficially. In the lower middle third of the radius there was an absence of continuity of the bone with a medial bowing deformity. Palpation of the interosseous

[1] Thorndike, A., Jr., and Dimmler, C. L., Jr.: Fractures of forearm and elbow in children; analysis of 364 consecutive cases. New England J. Med. 225: 475–480, September 25, 1941.

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space revealed it to be decreased in the midportion of the forearm. The impression was of a complete fracture of the midshaft of the ulna with ulnar angulation of the fragments, and a complete fracture of the shaft of the lower third of the radius with ulnar angulation.

There was a small abrasion on the palmar aspect of the forearm. The radial pulse was good, however, and there was no gross injury to the radial, ulnar, or median nerves.

Despite the absence of x-rays and special orthopedic appliances, it was decided to attempt reduction of the fracture. With local infiltration of the left brachial plexus good anesthesia was obtained within 20 minutes. Reduction was begun by flexing the forearm at right angles and carefully holding it to prevent motion in the fractures of the radius and ulna. Traction in the long axis of the arm was made by grasping the humeral condyles with the arm in slight abduction, and countertraction was used in the axilla. The shortening was overcome and the fragments manipulated into seemingly good alinement. A padded shoulder-spica cast was then applied to the arm down to the elbow and the forearm was brought to a position of 60° flexion. A muslin bandage about the wrist was used for traction in the long axis of the forearm and countertraction was obtained by grasping the still exposed humeral condyles. With steady traction the ulnar deformity was reduced by manipulation and the interosseous space molded to restore the normal space. The forearm was slowly supinated into the neutral position. A padded cast was applied down to the knuckles. A wooden strut was incorporated in the spica cast between the chest and the forearm.

Following reduction the fingers were warm and the circulation was good. Motion and sensation in the fingers returned several hours later.

The following day the patient was ambulatory and he had no complaints thereafter. On the second day the cast was extended to include the right shoulder. Progress was excellent during the remainder of the patient's stay aboard ship.

Six days after reduction of the fractures, x-ray films taken through the cast disclosed a comminuted fracture through the distal end of the shaft of the humerus with the fragments in fairly good alinement. There was a jagged T-shaped fracture in the distal end of the radial shaft about 8 cm. above the wrist joint, and the radial fragments were in good alinement and possibly slightly impacted. There was a double fracture of the ulnar shaft with good alinement of the fragments at the distal fracture and fair alinement at the site of the proximal fracture with some anterior displacement of the proximal end of the distal fragment.

Three days later the patient was transferred to a Naval hospital and was returned to active duty within 3 months.

COMMENT

Neither x-rays nor orthopedic devices are available aboard a destroyer, and in this case lack of paraphernalia and personnel for administering a general anesthetic was an added problem. Local infiltration into the fracture sites would have involved multiple injections. Brachial plexus block seemed to obviate these objections.

Although simple fractures of the humerus are not considered difficult to treat, complete fractures through both forearm bones, generally speaking, call for more elaborate treatment than simple manipulation and immobilization. Scudder states that:

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Fractures of the forearm probably offer more problems in mechanics than any other fractures in the body, not excepting the femur. A general anesthetic should always be used in attempting the reduction of displaced fragments of fractures of both bones of the forearm. It is quite apparent that when there exists a somewhat complicated displacement of the four ends of the fragments it may be almost impossible to reduce these fractures by simple traction and manipulation and immediate rigid fixation.

Despite these handicaps, the outcome of this case was excellent.

PRIMARY SKIN GRAFT FOR REPAIR OF TRAUMATIC SKIN LOSS

REPORT OF A CASE

AARON Z. OBERDORFER
Lieutenant (MC) U. S. N. R.

Deep lacerations of the face with loss of tissue substance respond well to primary skin-grafting. The following case illustrates the success and rapidity with which such injuries react to this type of treatment.

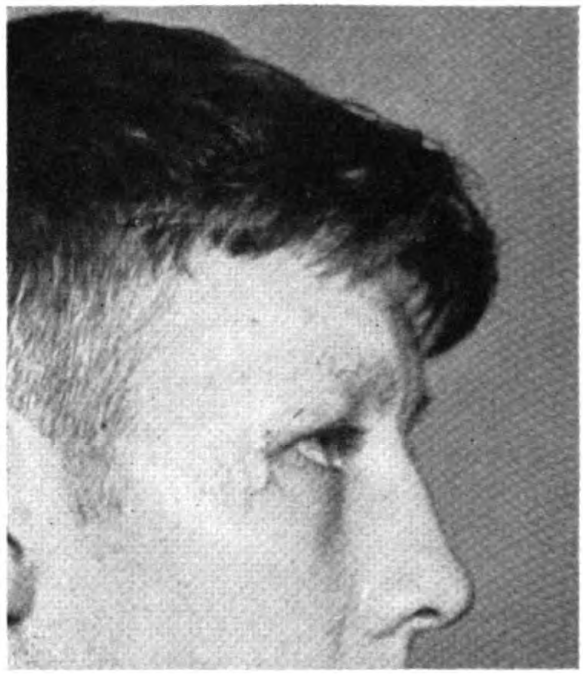


1. Showing condition at first change of dressing 5 days after grafting.

The patient, an aviation ordnance man, third class, age 20 years, fell from a bomb truck onto a hard coral roadway, striking the right side of his head.

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Examination upon admission revealed a stellate laceration of the right temple about 3 by 4 cm. with irregular outline and loss of full thickness of the skin in the central and lower portions. There was considerable contamination with debris and road dust and a moderate amount of devitalized tissue. Numerous minor lacerations, contusions, and abrasions were noted over the extremities.



2. Condition 10 days later.

The temporal wound was cleansed with soap and water, irrigated with normal saline solution and carefully debrided. Sterile sulfanilamide was dusted into the defect. Under procaine field block anesthesia a free graft was taken from the inner aspect of the middle of the left thigh. The graft was approximately three-fourths full thickness and was covered by a layer of gauze impregnated with 10-percent sulfathiazole ointment and held in place by a moderately snug pressure bandage.

The dressing was undisturbed for 5 days at the end of which time it was changed and the first photograph made. The absence of infection and the very evident viability of the graft were remarkable. Dressings were thereafter changed at intervals of 3 to 4 days. The second photograph was made approximately 2 weeks after injury.

The grafted area is now smooth, soft, and pliable. There is no deformity of the outer canthus. It is interesting to speculate as to the outcome in this case had the graft been unsuccessful. In all probability scarring would have been followed by contracture and deformity of the outer canthus which in turn would have required plastic surgery for correction.

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PARTIAL DENTURE PROSTHESIS AT ADVANCE BASES

EDMUND H. FRIZZELL
Lieutenant (DC) U. S. N. R.

At an advance base the dentist, with very limited facilities, must often resort to his own ingenuity in alleviating dental discomfort and even severe suffering, without having to resort to drastic measures. Supplies are limited and conservation of material is a necessity. The personnel on small outposts is restricted and the loss of one man's services creates a serious handicap. Also it is often impractical or impossible to transfer personnel to an area where prosthetic treatment is available. Furthermore, with changes in induction requirements, restorative dentistry is becoming a problem along with many other dental difficulties.

Many service personnel are now wearing partial dentures replacing so many teeth that if they were deprived of them it would be dangerous to their personal welfare. Those who require extensive repairs or replacements will be returned to bases equipped to care for their needs. A certain number, however, will require only minor repairs or adjustments and this group can be cared for at the outpost or advance base. A few suggestions are submitted.

Repair of broken bridge facings.—As an example of the technic used a case is cited. The patient had a six-tooth fixed bridge with porcelain facings. The bridge extended from the upper right second molar to the upper right cuspid. The facings were fractured by a blow to the area.

The procedure used in repairing the bridge was as follows. First, a buccal impression, including the backings and abutment teeth, was taken with impression compound and a plaster model was poured and trimmed. The missing pontics were carved on the model in base-plate wax, and an impression was taken in soft compound and quickly chilled. The impression was then separated from the model, the wax dummies were removed, the impression and model replaced in proper position, and an opening made in the occlusal aspect. The wax dummies were cast in amalgam. The facings were completed by cutting away the buccal surface in order to fill it with cement silicate for esthetic purposes. After trimming and polishing, the dummies were cemented into place with oxyphosphate cement.

With a later case a space in the buccal surface of the wax dummies was carved out to hold the silicate cement before taking the impression. Rather good results were obtained by this procedure, as well as conservation of material. This technic was used on both anterior and posterior teeth.

Repair of broken tube teeth.—Two technics were used here. If enough tooth bulk is present, the tooth can be replaced entirely with

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silicate cement. A small piece of impression compound is placed over the socket of the missing tooth, and the patient bites into it. The impression is quickly chilled. (This can be glazed by means of an alcohol burner, blowing an air-syringe through the flame.) The compound tooth is chilled and covered with a lubricant. The compound should be carved to represent the missing tooth. Another impression is then taken over the tooth in its entirety. The model is separated from the impression and the space is filled with cement silicate. The model is finally replaced over the tooth socket and after setting, is trimmed as necessary and polished.

In the event that the tooth to be replaced is not sufficiently bulky to warrant using the technic described, an amalgam tooth may be cast and cemented into place. Cement silicate may be used on the labial or buccal surfaces if desired.

Loose partial dentures.—Temporary relining material is suggested.

Improvising.—It will be necessary at times to resort to many improvisations. For example, the stock of contra-angle burs at this outpost was completely exhausted. Fortunately a supply of straight handpiece burs was available. They were readily converted into contra-angle burs at the machine shop and proved quite satisfactory under the circumstances. The carpenter and metal shops will often render invaluable assistance toward the solution of many dental problems in the field.

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MEDICAL AND SURGICAL DEVICES

ADAPTATION OF STANDARD QUONSET HUTS FOR DISPENSARY USE

EDWARD W. LOWMAN
Lieutenant (MC) U. S. N.

The wide dissemination of small, isolated military unit dispensaries in present war conditions demands ingenuity on the part of the medical officer assigned to such duty. The temporary nature of the station and the exigency of conserving cargo space render it impractical to supply small units with anything beyond the basic essentials for efficient operation. Consequently the medical officer at a new base is confronted with the problem of setting up a functioning dispensary with little more to work with than a few barren native shacks or Quonset huts and a minimum of medical supplies and equipment.

The locating and partitioning of the shacks or huts; the installation of equipment, lighting, plumbing and heating; the improvisation of tables, chairs, cabinets, benches, etc., can prove a laborious task. While, due to wide variation in situations and needs, no absolute standard can be set for planning such a unit, the history of this South Pacific base dispensary might afford suggestions for planning similar medical units.

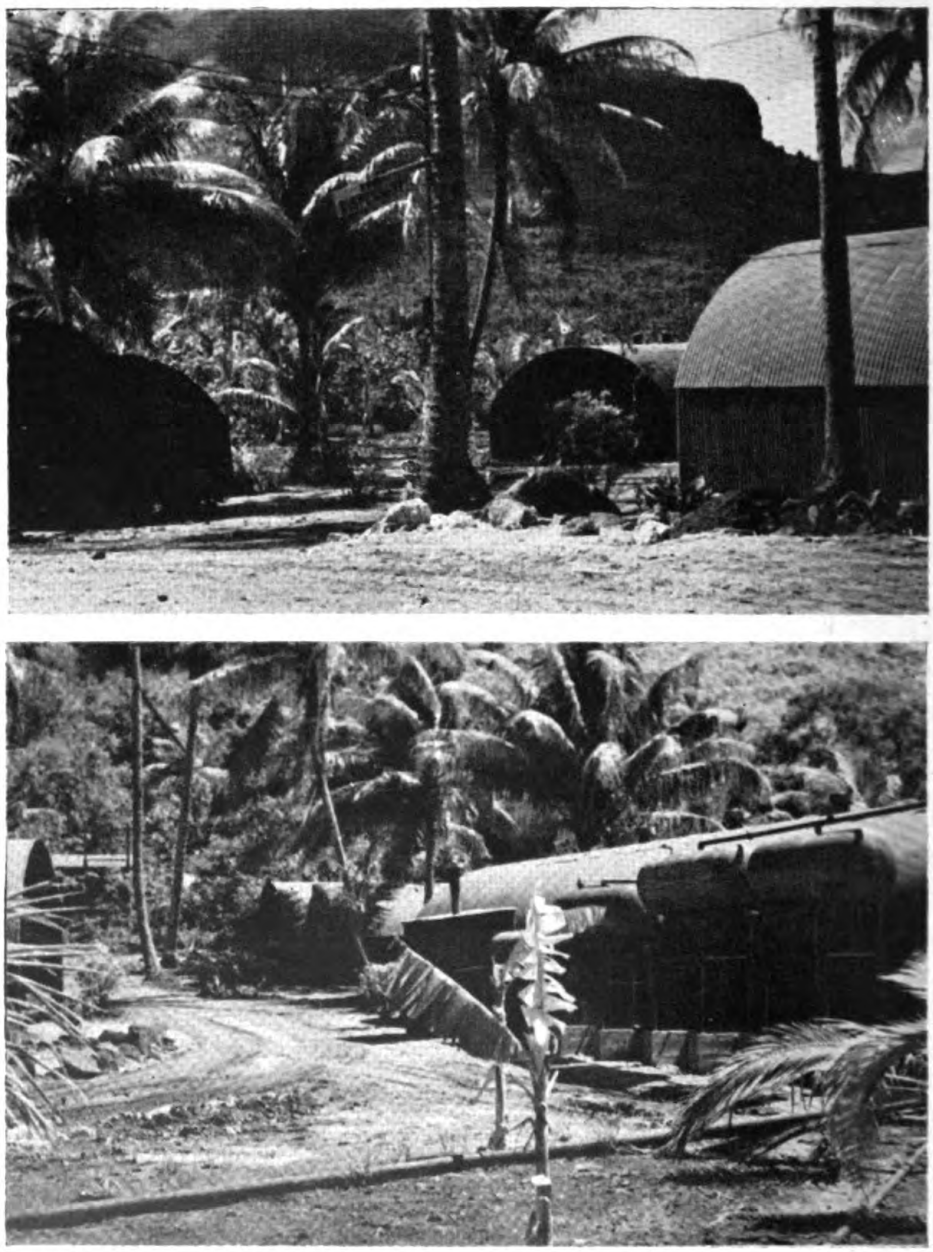
In this instance, 5 standard Quonset huts, 36 by 16 feet, comprised the dispensary which was to care for some 600 men. The first, referred to as the "dispensary hut," included a waiting room, a combined office and examining room, a pharmacy, and a record room. The second housed a laboratory, storage room, and study. The third was used as a surgery. The fourth served as a ward, and the fifth, added to assure availability of medical personnel in an emergency, quartered the corpsmen.

Standard Quonset huts are far better suited to small dispensaries than are the specialized, medical type. The latter are unnecessarily elaborate for small dispensary use and require too extensive an outlay of equipment and too large a complement of personnel.

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In selecting the dispensary site such factors as accessibility and danger from flood were considered. The huts were then grouped in a close circle on a centrally located area.

A large main generator supplied current to the huts. In addition, a 16-kilowatt, emergency standby generator was connected into the



1. General views of dispensary units.

circuit 75 feet from the dispensary to provide current in the event of disruption of the primary source.

Three 200-gallon copper tanks, originally intended for use with small oil-burning water heaters, were diverted for use as water storage tanks. A water supply of 600 gallons was thereby assured in case

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of seasonal drought or disruption of the main supply. Two of the tanks were used for cold water; the third was heated by means of an oil burner.

Four- by eight-foot sheets of Masonite, left from hut construction, proved ideal for partitioning hut interiors. Light in weight and durable, they were easily suspended on frames of 2- by 4-foot lumber with spaces left above and below to permit cross-ventilation and the passage of light.

Hut No. 1.—The waiting room of the first hut was furnished on two sides with benches made of 1- by 8-foot lumber, and with a small magazine table of equally simple construction. Patients attending sick call or returning for medication waited here for treatment.

In the examining room was a desk with an examining tray, a steel cot, and a scale. The length of the room from the front bulkhead to the first partition was 20 feet, marked off at 4-foot intervals to facilitate eye examinations.

The pharmacy, 8 feet in depth and adjoining the examining room, contained one large cabinet, a smaller utensil cabinet, a sink with drainboard and a wall shelving unit. In lieu of standard equipment, the large cabinet was constructed of plywood by the carpenters. The top section was built with shelves of varying depths to accommodate the different-sized, standard, Navy stock bottles. The large locker space below was suitable for the storage of alcohol and narcotics on issue to the pharmacy. The spacious top, acid-proofed, provided ample room for preparing prescriptions. Electrical sockets, incorporated into the sides of the cabinet, provided connections for the hot plates needed in compounding prescriptions.

The smaller cabinet, similarly constructed of plywood and Masonite, afforded storage space for pharmacy utensils, scales, etc. One large lower shelf was filled with 1-gallon vinegar jugs in which were kept stock solutions such as boric acid, magnesium sulfate, calamine lotion, etc.

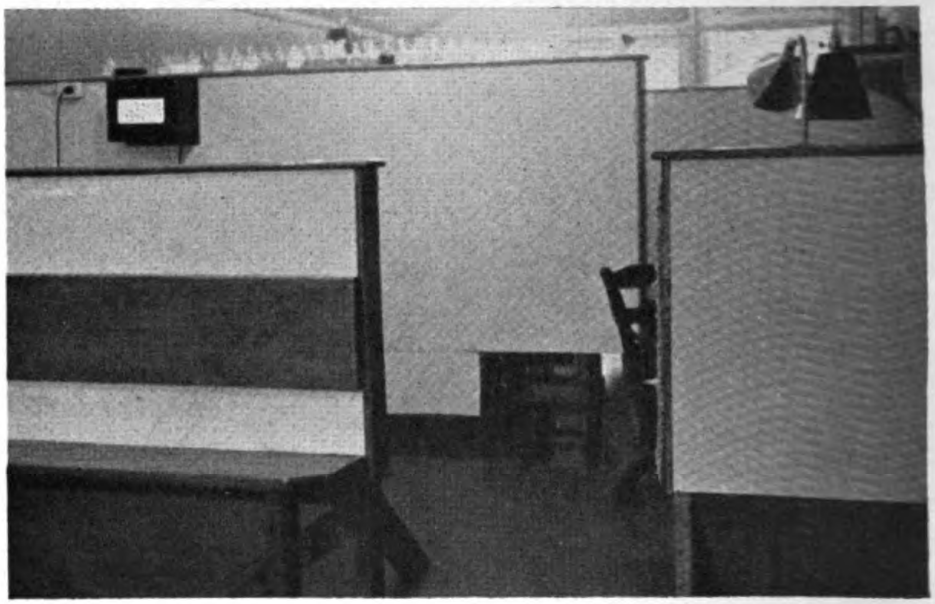
The wall shelving unit, of standard Quonset hut-type, was used for maintaining conveniently at hand a supply of those drugs commonly required by the pharmacy. A mop sink was installed along one wall with a sloping wooden drainboard. Galvanized tin from a metal rain tub was used to fashion a trough covering for the drain. A particularly useful and simple cabinet was a capsule dryer. In the tropics high humidity renders ordinary capsules damp, sticky, and useless. From two plywood stormblinds a small box was constructed. The heat from a 60-watt electric light bulb kept capsules satisfactorily dry and ready for use.

Hut No. 2.—The following space was allotted to the three sections of the second hut: The front 8 feet to a laboratory, the central 20

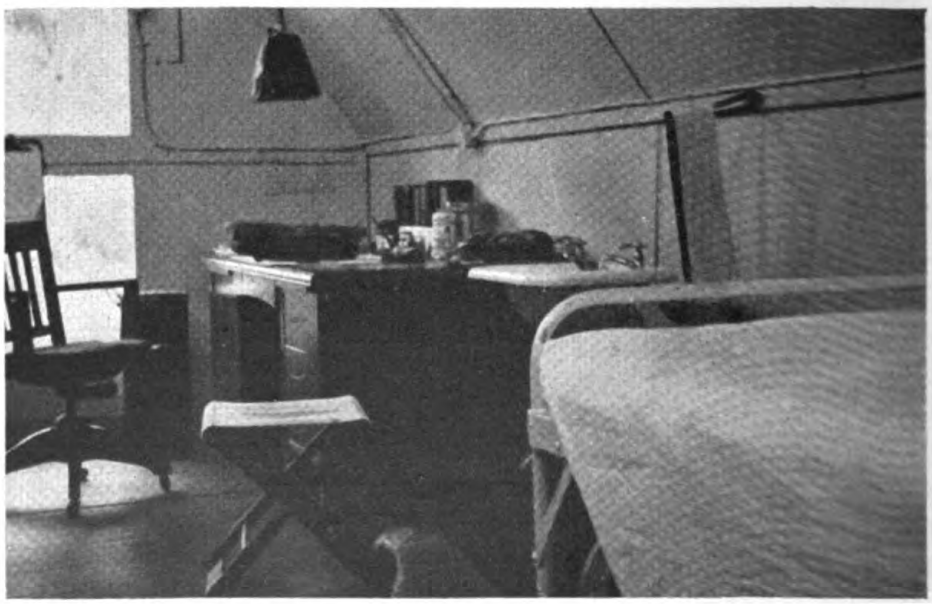
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feet to a storage room, and the back 8 feet to a study. In the laboratory all cabinets, shelves, stools, and tables were made by the carpenters. Along the front window a shelf of 1- by 8-foot lumber with an acid-proofed top provided a spacious place for doing micro-



2. Interior of Hut No. 1, showing Masonite partitioning.



3. Medical officer's examining room.

scopic work in adequate, natural light. A cabinet having a top made of 1- by 8-inch acid-proofed lumber, sliding plywood doors, and deep shelves was installed along one wall for the storage of glassware. A small table held the electric incubator. The sink was provided with a galvanized tin, sloping, drain trough similar to that

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in the pharmacy. A small shelf to hold reagents was conveniently at hand for staining slides over the sink.

The space allotted to the storeroom, 20 by 16 feet, adequately cared for the storage of drugs and excess equipment. There were two wooden shelves around three sides of the room. In addition, three steel racks accessible from either side and originally installed down the center of the room, were later replaced by a pair of wooden shelving units placed back to back and affording more space. Thus ample room was provided for the arrangement of drugs according to alphabetical stock catalog classification. Here also was kept an inventory stock card file.

Except in emergency, supplies were issued to the various units on a weekly basis on Mondays. A wooden locker, approximately 2 by 2 by 3 feet, secured under lock and key excess alcohol and narcotics exclusive of those distributed to the pharmacy, battle stations, and surgery. The rear 8 feet of this hut was reserved as a study for the medical officers, where reading, or writing of records might be carried on. A single entrance from the rear assured privacy. Furnishings, constructed by a carpenter, consisted of a shelved cabinet, a large bookshelf, and a reading table.

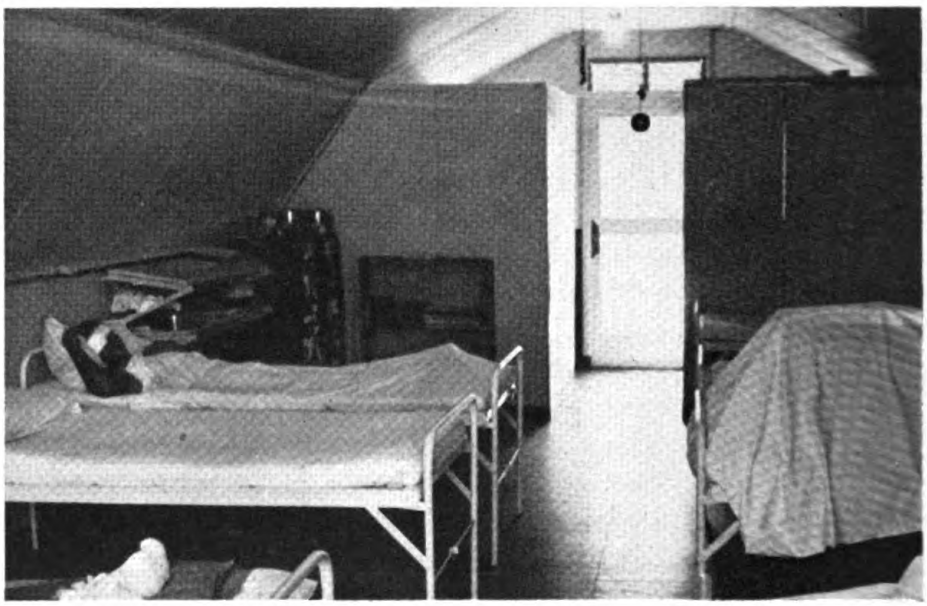
Hut No. 3.—The forward 8 feet of hut number three, the surgery hut, was allotted as a surgical dressing room. The shelves of a wooden cabinet 8 by 4 by 3½ feet were stocked with bandages, adhesive, gauze, antiseptics, magnesium sulfate, etc. The top of the cabinet held routinely used stock medications, cans of sterile dressings, an instrument tray, the sterilizer, bandages, etc. A standard Navy metal treatment chair and instrument stand were used here. A sink with a metal trough drainboard was installed along one wall.

Just aft and to the right of the dressing room, a section 6½ feet wide by 8 feet deep was partitioned from deck to ceiling to provide an x-ray darkroom equipped with developing tanks, a shelving unit, and a plywood box lined with sheet lead for storing "live" film. To the left of the dressing room, a similar 6½- by 8-foot area was partitioned on two sides with Masonite to form a cubicle for the administration of physical therapy. Equipment in the latter included a wooden plinth covered with a folded blanket encased in a sheet, a carborundum element heat lamp and a body baker. This equipment was in constant use.

The aft 20 feet of the hut was the surgery. A portable x-ray machine and an operating table were the only standard equipment on hand. Surgical scrub basins, complete with foot pedals and goose-neck faucets, were rigged by the plumbers from two washbasins. A concave, wooden overhead fixture built by the electricians lighted the operating table. Two-hundred-watt bulbs in eight regular pull chain

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light sockets, each set at a different angle on the concave base, gave ample light over operative fields and with the exception of the heat generated, the fixture was an acceptable substitute for a surgical lamp. The pull chains made it possible to burn only the desired number of bulbs. From double shelving units, originally intended for the ship's service type of Quonset hut, cabinets with doors made of stormblinds were improvised for surgical instruments and supplies. In one of these, muslins, blankets, towels and sheets were stored. Another held instruments; a third, bandages, adhesive, and cotton. A fourth was devoted to sterile goods, plasma, suture materials, emergency supplies of narcotics, infusion apparatus, etc. which must be readily accessible in the event of casualties.



4. Ward interior; head, shower and utility room in background.

The ordinary mesh screen afforded no protection from small flies. Single layers of muslin tacked over the windows inside the screens solved this problem and at the same time excluded no appreciable amount of light. The deck of the surgery hut was of concrete and sloped gently to a central drain beneath the operating table. On the back porch of the surgery a cabinet of 2- x 4-inch lumber and 4- x 4-foot Masonite extending upward to the sloping roof stocked a supply of boric acid, soap, scrub brushes, fuel oil, gauze, rubber hosing, etc., needed in the decontamination of gas attack casualties.

Hut No. 4.—The forward 28 feet of the fourth hut, the ward hut, was partitioned off and furnished with nine steel cots. Ordinary folding canvas cots could be substituted. Five cots were placed on one side of the ward, 4 on the other together with a cabinet for books, magazines, and medical supplies. Between the cots, regular Quonset-

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type shelves were hung from metal wall braces within easy reach of bed patients. The rear 8 feet was divided by a center passageway 3 feet in width which extended to the back porch. The partitioned area to the left housed dishes, silver, a food carrier, and linens for the ward, together with a large sink for dishwashing. Food brought in the carrier from the main crew's galley was individually served from here to ward patients and corpsmen on duty. The right partitioned area was jointly a toilet and a shower.

A space 3½ by 4 feet was partitioned off for the shower. The toilet was a two-seater, chemical tank in which caustic soda was used. On the partition by the toilet a wooden rack held bed pans and urinals. It was found that the presence of a chemical tank within the ward provided a constant, odorous nuisance. Caustic soda was ineffectual in reducing the disagreeable stench; frequent, necessary pumpings with a mud hog added to the offensiveness. Accordingly, the tank was shifted out of the building proper onto the back porch where it could be partitioned off and remain accessible (but inoffensive) to patients. On the back porch of the ward a wooden bin 4 by 3 by 3 feet was used as a locker for dirty linen.

In addition, because of the high incidence of trichophytosis, there was here a cabinet designed by the carpenters with the help of a metalsmith, for fumigating shoes. Made of wood and lined with galvanized tin, the cabinet had upper shelves for contaminated shoes and a lower shelf for containers of disinfetcing formaldehyde. The door fitted snugly and, when clamped with iron flanges, provided an airtight sterilizer which proved quite satisfactory in minimizing reinfection with fungus from contaminated shoes.

The dispensary procedure which evolved after some experimentation was as follows: Patients coming to sick call reported to hut No. 1, the dispensary hut. Here in the waiting room a corpsman filled out a slip on which was entered the patient's name, his chief complaint, and temperature, pulse and respiration data. With this slip the patient was presented to the medical officer for interview. When treatment was felt necessary, the medical officer made a note of this.

If the patient was to receive medicine, he remained in the waiting room and received this from the pharmacy adjoining. When a patient required a bake, massage, dressing, or the like, he reported to the surgery, where he was ministered to by the corpsmen on duty. If laboratory work was required, the patient reported with his slip to the laboratory in hut No. 2, returning with a report of the laboratory procedure to the waiting room to be seen again by the medical officer.

Thus, with four corpsmen on duty, one in the waiting room filling out slips and directing patients to the medical officers, one in the pharmacy administering medications, one in the laboratory running

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tests, and a fourth in surgery doing dressings and physical therapy, it was possible to expedite quite efficiently the large volume of daily sick calls.

In conclusion, the medical officer faced with the job of establishing a small base dispensary for which little standard equipment can be furnished, must devise and improvise and substitute. A good carpenter and plumber are essential to the success of his improvisations; efficient planning and organization to the proper functioning of his unit. Though the needs of every small dispensary and the materials available for construction of that dispensary would vary in different circumstances, the ideas incorporated into the unit described might afford shortcuts for a medical officer with a similar problem.

IMPROVISED CANVAS STRETCHER SUPPLEMENTING THE STOKES STRETCHER ON CARRIERS

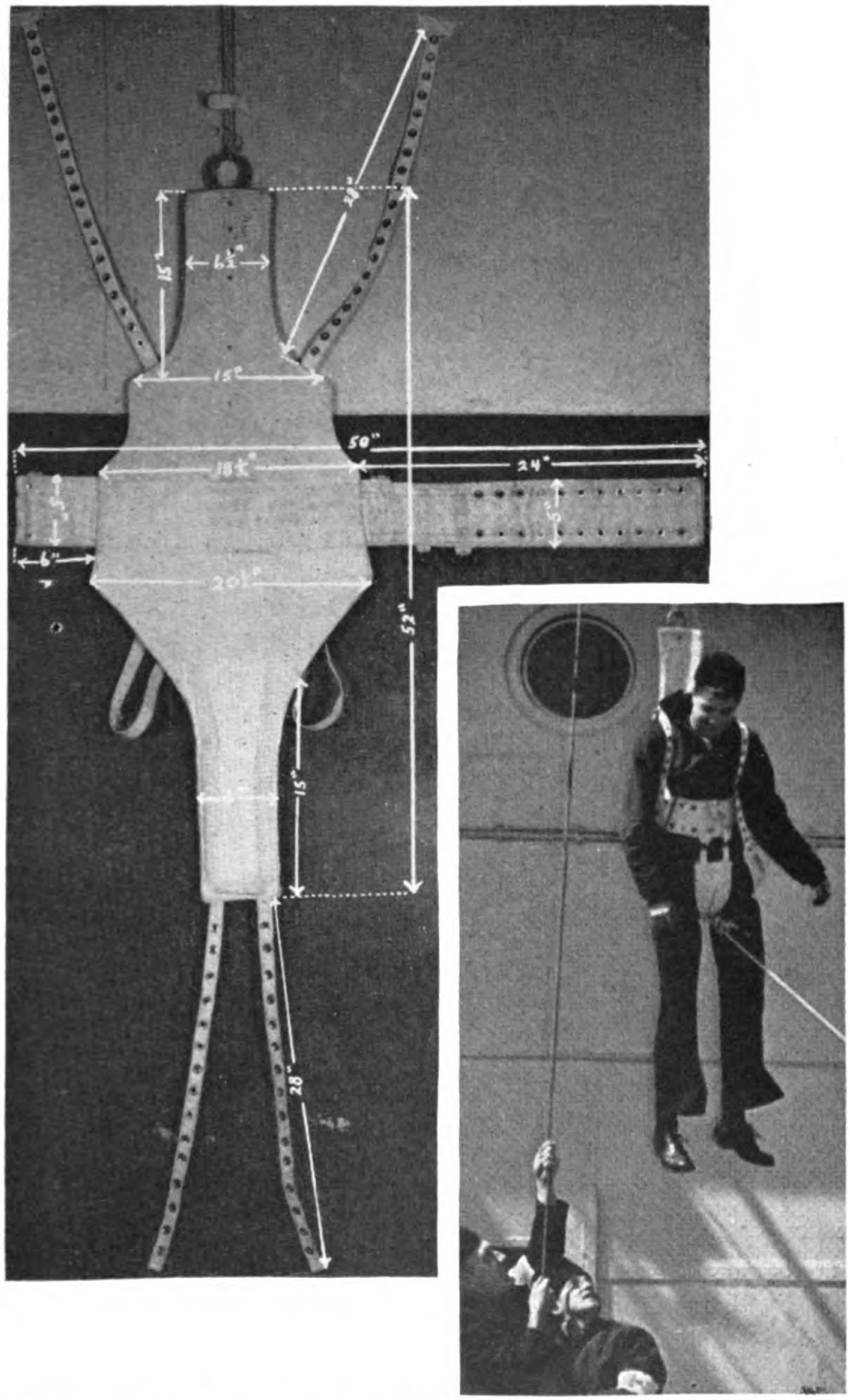
EVERETT M. BESSIE
Lieutenant Commander (MC) U. S. N. R.

A number of canvas stretchers have been described, each with various advantages, and each meant to supplement rather than to replace the standard Stokes type. On this carrier there are a number of spaces, particularly in and around the island structure, where the use of the Stokes stretcher is either impossible, due to narrowness of passageways and smallness of areas involved, or impracticable due to excessive loss of time in bringing the Stokes into maneuverable position.

The different types of canvas stretcher were carefully examined and a simplified version decided upon as most easily made aboard ship and most practicable for our specific purposes. Simple manufacture, small storage space, and the fact that a casualty can be carried by a single stretcher bearer, are claimed for this vertical canvas stretcher. In practical drills it has been most satisfactory.

Care should be taken to see that the perineal stretch of canvas is well padded. Casualties to be handled in this type of stretcher must be carefully selected, as obviously such an injury as a fractured spine cannot be handled without increasing the danger of further trauma to the patient.

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1. Dimensions of stretcher and demonstration of its use in lowering patient in vertical position.

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AN IMPROVED FILING CABINET FOR 35-MM. FILM

ARTHUR B. ROBINS
Lieutenant (MC) U. S. N. R.

The development of photofluorography and photographic reproduction of x-rays on 35-mm. films has greatly simplified the x-ray storage problem. The ease with which miniature films can be filed and stored has been one of the features contributing to the rapid growth of the method. The amazing degree to which storage space for conventional 14- by 17-inch roentgenograms can also be reduced by the use of 35-mm. photographic reproductions has been recently demonstrated by Siegel.[1]

The current shortage of metal and difficulty in securing x-ray film cabinets has further accentuated the need for methods of conserving space and files. Unfortunately no really satisfactory cabinet for filing microfilm is, or has been, commercially available. The files specifically designed for this purpose were of the horizontal drawer style with all the disadvantages of this type of construction. Due to priorities in metal even these can no longer be secured and one must resort to improvised methods of filing in standard letter-size or x-ray filing cabinets.

A satisfactory cabinet for filing small films or reproductions should meet certain basic requirements:

1. It should occupy the minimum space for the number of films stored.
2. All films should be readily accessible.
3. The identifying data of each film roll should be plainly visible.
4. The construction should be such that a person of limited muscular strength can locate and file films without danger of strain or injury.
5. As little critical material as possible should be used.

Additional features which are desirable but not essential are humidification and complete fireproofing. Humidification has been highly recommended for film storage cabinets; however in practice it has not been shown to be of decisive advantage. Complete fireproofing is of particular importance when films are to be stored in buildings where the fire hazard is great. The film itself is noninflammable.

The problem of providing filing equipment to meet these requirements presented itself in conjunction with a chest x-ray survey program at a navy yard. This program, calling for x-raying civilian personnel entering and engaged in production activities in the yard, utilizes 35-mm. photofluorography. It is anticipated that over 50,000

[1] Siegel, A. J.: Film filing—modern way. Radiology 34: 738–741, December 1940.

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individuals will be examined annually. The films of these workers must be kept readily available for immediate review and future reference. Storage space for current films is limited, and the filing is done almost entirely by female clerical personnel. The cabinet shown in figure 1 was designed for this purpose, and was built in less than 1 week by a cabinet maker.



1. An improved filing cabinet for 35-mm. film.

The cabinet is composed entirely of wood except for the hardware. It is 54 inches high, 36 inches wide, and 11 inches deep, exclusive of the stand. Its volume is approximately 12.4 cubic feet, and its weight, empty, about 75 pounds. When filled the cabinet holds 1,518 rolls of film. As each roll contains 40 x-rays of 35-mm. size, the capacity of the file is 60,720 films.

Films are filed so as to be located readily with a minimum of muscular effort by the use of leaves which swing out, as shown in figure 1.

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The front doors are swung back showing the film racks on the back of doors; not showing are those on the front of the inner leaves. The inner leaves are swung partly open showing the racks on the backs of the leaves and on the front of the back panel of the cabinet. Each



2. Showing details of recording and storing.

side of each leaf contains 23 racks holding 8 rolls each. The back panel has 23 rows, each containing 19 rolls. The racks are narrow strips of wood with holes cut out just large enough to hold the cardboard box in which the rolls are kept. These racks are set into side grooves. The strips are mounted at a slight inclination to the vertical

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to prevent the boxes from falling out when the cabinet is opened or the leaves turned.

The identifying data for each roll are entered on the cover of the cardboard box containing the roll and include the name of the survey, the number of the roll, the numbers of the films included on the roll, and the date the x-rays were taken. The information pertaining to each roll is readily visible at all times, as shown in figure 2. The rolls are filed consecutively and it is a matter of seconds to locate the roll containing any particular film. The slight inclination of the racks does not in any way interfere with the filing or locating of the rolls. The cabinet has been in use at the navy yard for over 3 months and now contains over 10,000 films. It has proved entirely satisfactory in constant daily operation.

By slight modification of the dimensions and size of the racks and holes a cabinet of this type can readily be constructed to accommodate films in larger or smaller rolls. When metal is available the cabinet can be built of steel and will then be completely fireproof. For the present, it can easily be constructed of wood by any competent cabinet-maker at a very low cost in a minimum of time.

PROSTHETIC APPLIANCE FOR WAR INJURY

FRANK E. JEFFREYS
Commander (DC) U. S. N.

In peacetime extensive maxillofacial injuries were quite rare and were usually the result of automobile or aviation accidents. As these injuries were generally not too severe and hospitalization with complete treatment could be provided immediately, the prosthodontist's work consisted more or less of routine replacements. A fixed bridge or a partial denture to replace the missing teeth would generally provide suitable masticating surfaces and would restore the original appearance of the patient.

During wartime, however, an increased number of severe casualties are presenting themselves for prosthesis. While in many of these cases, simply supplying the missing teeth will restore the patient to an esthetic normal, it does not necessarily mean that a functional normal will follow. The mutilation may be such that even after the missing teeth are replaced the patient will be unable to chew due to lack of proper or suitable occlusion. The correction of this type of casualty demands that new technics be devised and new principles be applied. In short, jaws must be rebuilt and missing tissues replaced.

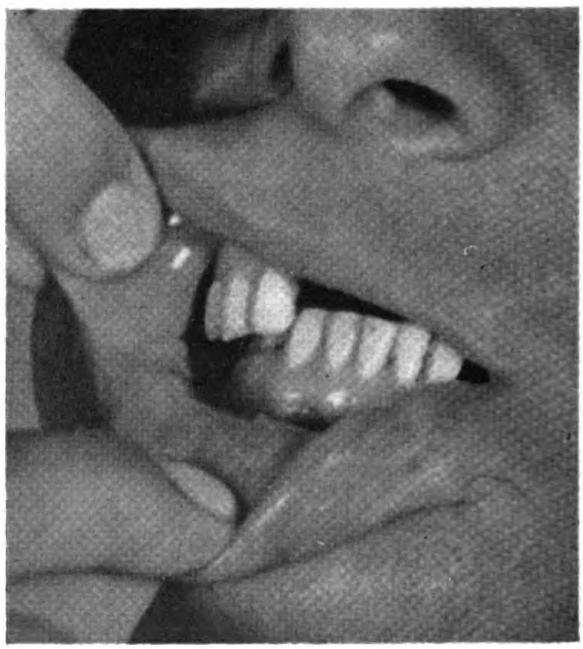
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The handling of such a case is explained in the hope that it may assist in obtaining a more pleasing appearance and efficient function in cases of a similar type.

CASE REPORT

A signalman in the Royal Navy, was struck in the lower left cuspid area by a piece of shrapnel. The mandible was fractured in that area and in the right cuspid and right first molar area. The shrapnel traveled upward and took with it teeth 7, 8, 9, 10, 11, 12, and 13, the entire alveolar and palatine processes of the maxillae in that area, and a considerable amount of soft tissue from the left cuspid-first bicuspid area.

The opening from the mouth into the nasal cavity, which resulted from the injury, had been almost closed by a series of operations over a period of months.



1. With mouth closed there was total lack of occlusion between upper and lower teeth.

An incision closely hugging the alveolar margin freed the palatal tissue from the right second bicuspid area to the cleft in approximately the left cuspid area. This flap was then moved to the left and sutured so as to cover the cleft. A small opening still persisted and the base of the flap was humped up in a slight fold across the roof of the mouth. This was the clinical picture of the mouth at the time the patient presented himself for treatment.

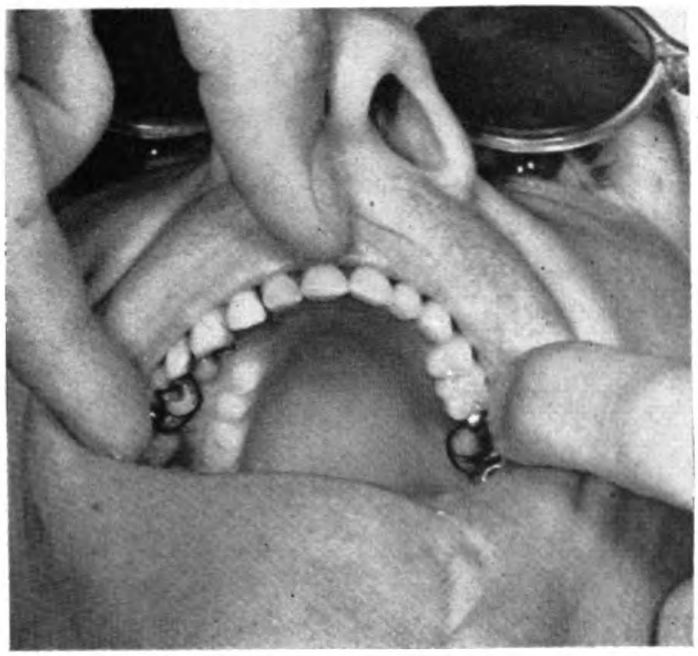
Study models of the mouth were made. The upper right arch was intact and apparently in perfect alinement except for the absence of the first molar and the central incisor. Only teeth 14 and 15 remained in the upper left arch. The lower right molars were inclined rather sharply to the lingual. A difficult problem of malocclusion was disclosed upon occluding the study models. The lower right molars fitted entirely inside the uppers and almost touched the palatal tissue, causing the upper right molars to close outside the lowers and touch the buccal gingival tissues (fig. 1).

The inclination of the lower right molars and the history of the fracture in that area led to the assumption that the mandible had been allowed to heal in

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a lingual relation to the maxilla. However when the setup of the artificial teeth in the patient's mouth was begun, it was found that although only the right central was missing on that side in the anterior arch, a large artificial right lateral and central were put in before coming to the midline of the mouth and face. This proved the original assumption regarding the malposed mandible to be in error and showed that the entire right maxilla had moved one-half inch to the right and down three-eighth inch, thus putting it completely buccal to the mandible. This malposed union obviously made the right side useless for masticating purposes.

The treatment consisted of the restoration of esthetics and mastication. Unlike practically all other cases, an appliance to replace the missing teeth and push out the sunken soft tissues would not restore mastication. For this reason these two requirements were dealt with entirely separately.

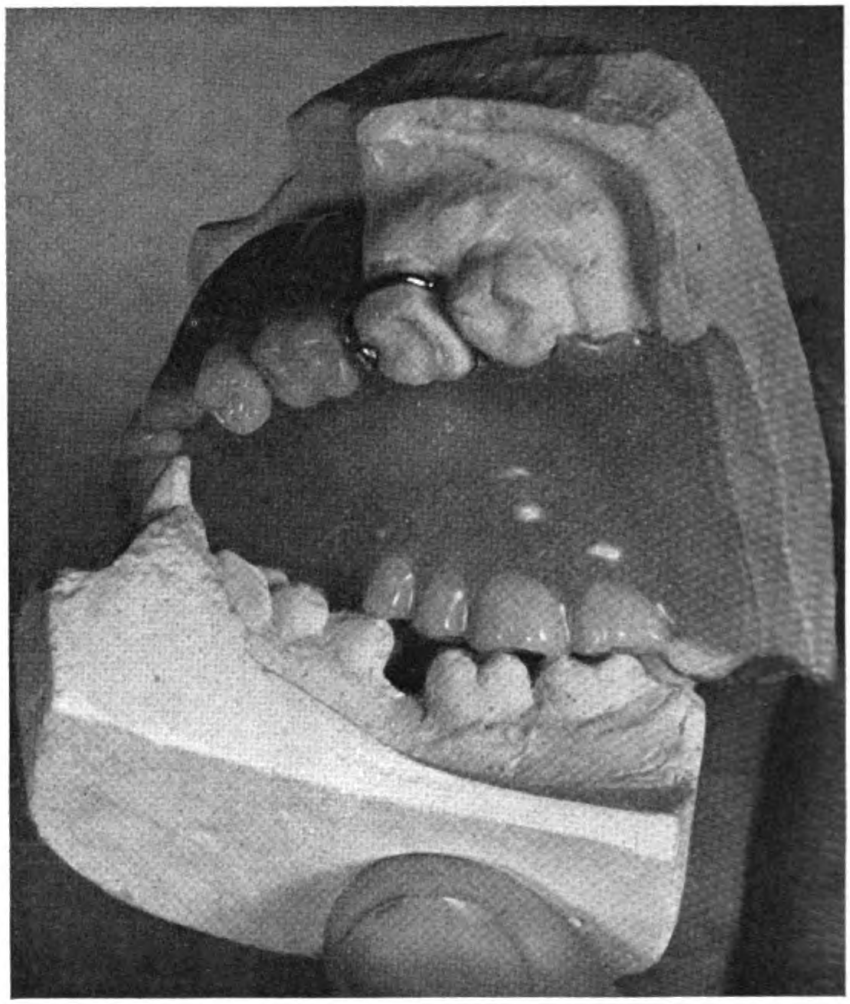


2. Appliance in mouth. Note second or inner row of upper teeth.

Cast gold clasps were made for teeth 2 and 14 in conjunction with a full palatal baseplate. The artificial teeth were set up in the mouth and, as mentioned above, it required the placing of both right central and right lateral incisors although only the right central incisor was missing. After the artificial teeth were arranged to obtain the best esthetic effect the case was carefully plumped with utility wax to restore the destroyed tissue and pad out the sunken cheek and lips. This plumping made the obturator more than 1 inch thick in the left anterior region. Next, indicator gel was used as a lining to correct the finished temporary denture. The case was then poured, flasked, packed with acrylic, and cured.

The cured denture was checked in the mouth and the occlusion corrected as required. It was decided to set an extra row of posterior teeth on the

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3. Second row of upper teeth occluding with lower teeth.

right palate to occlude with the malposed lower teeth (fig. 2). Four artificial lower right posterior teeth were inverted and placed lingually to the upper right natural posteriors so as to occlude with the lower right teeth. These teeth were cured in position (fig. 3). This unorthodox set-up gave the man satisfactory masticating surfaces on both sides of the mouth.

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EDITORIALS

ATYPICAL MALARIA

Describing the failure of two cases of acute nephritis to respond to accepted antinephritic management, Das [1] resorted to massive doses of quinine intramuscularly. Although the malarial organism could not be demonstrated in the blood smears, the extremely high incidence of malaria in the areas in which the patients lived led to the assumption that possibly this disease lay masked under the generalized anasarca, albuminuria, hematuria and scanty urine. A total of four daily injections of quinine brought remarkable improvement and after two weeks both patients were discharged from the hospital as clinically cured.

These cases direct attention to the role malaria is expected to assume in medicine of the immediate future. As recently discussed in this BULLETIN,[2] malaria may mask any of the more familiar diseases. The clinical picture attending the combination of any of the more common diseases with the less familiar parasitic disease which tropical war has thrust upon American medicine, may be so modified that neither disease entity will be suspected.

The bizarre manifestations of malaria add one more possibility to the list of differential diagnoses to be considered in a variety of common illnesses. No longer can the comatose patient be thought of exclusively in terms of diabetes, uremia, cerebral accident or trauma. Coma is a most serious symptom of cerebral malaria, and almost always portends a grave prognosis. The acute meningeal syndrome and the psychic aberration that follows residual brain damage are frequent sequelae of a malignant malarial infection.

No system is spared in malaria. Invasion of the respiratory system may simulate all the symptoms and signs of an early pneumonia. On the other hand, to find plasmodia in the blood stream of a patient suffering from a true pneumococcic pneumonia may become common

[1] Das, K. N.: Two cases of malarial nephritis treated successfully with quinine. Indian M. J. 37: 132–133, September 1943.

[2] Editorial. Gastro-intestinal diseases in the Navy. U. S. Nav. M. Bull. 42: 470, February 1944.

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and necessitate a multiplicity of diagnoses,[3] as well as call for an intelligent therapeutic management.

The acute enteritis leading to collapse, the severe vomiting, abdominal pain and violent diarrhea with muscular cramps and urinary suppression may be entirely of malarial origin and represent the algid, choleriform or dysenteric aspects of the disease. Each, however, may be true shock, cholera or dysentery, and it may require considerable diagnostic acumen to distinguish them.

Hepatic and splenic involvement are too well associated with malaria to be overlooked. Malarial cachexia and anemia are equally familiar, while skin manifestations of a scarlatiniform or morbilliform type having demonstrable parasites in the surface capillaries, herpes of the lips, urticaria and a generalized miliary purpura are repeatedly finding space in the current literature [4] on exotic forms of malaria.

The extent to which this situation will color the medical outlook of the country depends upon a multiplicity of factors. Ultimately however they are reducible to the presence and activity of the anopheline vector. The vigorous measures now instituted will minimize somewhat this potentiality. However the problem is so real that no clinician can afford to disregard the possibilities.

VENOPRESSOR MECHANISM IN PRODUCTION OF SHOCK

The voluminous literature on the cause of shock merely reveals the highly complicated mechanism involved. Its real nature is still an enigma. In fact a simple comprehensible definition is yet forthcoming. All of which points to the reasonableness of the assumption that shock is probably not the result of a single entity but rather of a summation of factors either operating cumulatively or following in rapid succession, each having such compelling influence that any one may be confused and mistaken as the sole instigating force at work.

That peripheral circulatory failure is one of the cardinal manifestations of shock needs little comment. The mechanism involved in its production however is not as indisputably certain. Diminution in the peripheral venous pressure assuredly occurs, but the story of the relationship of the intravascular pressure to complete circulatory failure is a complex one.

Maintenance of an effective cardiovascular function depends not only upon the integrity of the heart muscle but also upon the quantity of blood flowing into the heart's chambers.

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[3] Current Comment: Postwar dangers of tropical parasitic diseases. J. A. M. A. 123: 772, November 20, 1943.

[4] Kneedler, W. H.: Malignant and atypical malaria. Clinics 2: 809–827, December 1943.

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The role of the venopressor mechanism in maintaining this function has been the subject of numerous writings.[1 2 3] Henderson, Gunther and others have repeatedly called attention to the rhythmic contraction of the skeletal muscles in initiating and maintaining this pressure. The physiologic principle of muscle tonus is considered responsible for its operation. The alternating contraction and relaxation of groups of muscle bundles even when the body is in complete rest exert a pump-like action that creates venous pressure and sustains circulation.

A flaccid skeletal musculature whatever its source produces a fall in intramuscular pressure, the capillary pump ceases to operate and the venous return to the heart diminishes. Since the heart is filled entirely passively the amount of blood expelled by the heart depends upon the amount which enters during diastole. Any significant diminution in the filling of the cavities of the right side of the heart necessarily results in a decline in the cardiac output, a decrease in arterial circulation and a fall in systolic blood pressure.

As Groskloss has indicated elsewhere in this Bulletin (p. 501), from the disparity between the volume of blood and the volume capacity of the vascular system peripheral circulatory failure follows. Capillary atony and tissue anoxia become reciprocal. Cerebral oxygen consumption decreases and the vital centers of the brain share in the anoxic state. Thus from a relative, an absolute condition of anoxia is set into operation.

These facts along with the rapid circulatory collapse observed in fainting, "knock out" blows, and the primary shock of battle casualties, point forcibly to a neurogenic control of this mechanism.[4] It is claimed that stimuli coming through the motor nerves from motor nuclei of the spinal cord and bulb maintain muscle tonus. Other factors however are not necessarily excluded. The myogenic origin of muscle tonic activity is supported by a number of rudimentary experiments in physiology.[5]

Irrespective of the controversial issue, serious impairment of the general health, physical depression accompanying acute or chronic illness, and even psychic aberrations are known to affect muscle tonus. The relationship of venopressor mechanism to peripheral circulatory integrity seems established whatever its role in the production of shock.

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[1] Henderson, Y.: Tonus and the venopressor mechanism: the clinical physiology of a major mode of death. Medicine **22**: 223–249, 1943.

[2] Gunther, L.; Strauss, L.; Henstell, H. H.; and Engelberg, H.: Intramuscular pressure; action of various drugs on patients with normal intramuscular and venous pressure. Am. J. M. Sc. **204**: 387–394, September 1942.

[3] Editorial: Failure of the venopressor mechanism as a factor in the development of shock. Ann. Int. Med. **19**: 817–819, November 1943.

[4] Harrison, T. R.: Arterial and venous pressure factors in circulatory failure. Physiol. Rev. **18**: 86–108, January 1938.

[5] Starling, E. H.: Principles of Human Physiology. 8th edition. Lea & Febiger, Philadelphia, 1941. p. 176.

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PATULIN

Workers in this laboratory have been engaged for some years in a systematic study of the metabolic products of the lower fungi (moulds). Some time ago a metabolic product of *Penicillium patulum* Bainier which had not been previously encountered here, was isolated and shown to have antibacterial properties.

Patulin is about equally bacteriostatic to both gram-positive and gram-negative organisms; it is much less active than penicillin against gram-positive organisms but much more so against gram-negative ones.

The bacteriostatic power of the substance is unaffected by the presence of serum or pus.

The phagocytic activity of leucocytes is unaffected by a 1 in 8,000 solution, but inhibited by a 1 in 2,000 solution.

The lethal dose for mice is about 0.5 mg. per 20 gm. bodyweight, whether the substance is given intravenously or subcutaneously. Subcutaneous administration produced necrosis at the site of injection.

During the first four months of this year patulin was given a trial in the treatment of common colds which were prevalent at a naval establishment in the southeast of England. Solutions of the substance were sprayed into the nose or snuffed up from the hand.

The results obtained were encouraging, 57 percent of the treated cases recovering completely within 48 hours, compared with only 9.4 percent of the controls. No ill effects were observed.—Raistrick, H.: Patulin in the common cold; collaborative research on a derivative of Pencillium patulum Bainier. Lancet 2: 625–635, November 20, 1943.

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Washington, D. C.

(For review)

THE MODERN TREATMENT OF SYPHILIS, by *Joseph Earle Moore, M. D., Associate Professor of Medicine and Adjunct Professor of Public Health Administration, The Johns Hopkins University;* with the collaboration of *5 other prominent physicians, all of whom are members of the faculty of The Johns Hopkins University.* Second edition 1941; second printing 1943. 717 pages. Charles C. Thomas, Springfield, Ill., publishers, 1943. Price $7.

This excellent book covers all aspects of the treatment of syphilis and its complications in accurate, easily-understandable detail; discussing in a thorough manner technical problems and treatment of early, latent, and late syphilis, as well as specific subgroups such as cardiovascular syphilis, and antenatal prevention of congenital syphilis (the latter two of which were presented as separate revised chapters by associates of the author).

The chemotherapeutic agents used in the treatment of syphilis are compared as to chemical structure, toxicity, effectiveness and mechanism of action. Technical aspects of preparation, administration, and complications are clearly and concisely presented.

The latest information on technic, methods and present results of intensive arsenotherapy of early syphilis is included in one chapter that discusses all interesting and important problems and reactions fully.

A timely, well-written and valuable chapter on venereal disease control in the Army and Navy should be a "must read" on every medical officer's reading list, for it contains up-to-date statistics on incidence; cooperation with civilian health agencies; prophylaxis; education of personnel; prostitution; the duty of the venereal disease control officer; and tables listing Army and Navy orders, regulations and documents directly concerned with venereal disease control.

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The printing, diagrams and tables are satisfactory. The subject index is complete and well "cross-indexed" for easy reference. The binding and cover are of good quality.

A SYNOPSIS OF CLINICAL SYPHILIS, by *James Kirby Howles*, B. S., M. D., M. M. S., *Professor of Dermatology and Syphilology, and Director of the Department, Louisiana State University School of Medicine.* 671 pages with 121 text illustrations and 2 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers. 1943. Price $6.

This small (5″ x 8″) book is a handy, hurried reference source, well written and informative.

It is especially recommended for medical officers at advance bases, aboard ship and those anywhere who desire to "brush-up" on their syphilology. The book contains a general description of the stages of syphilis, clinical and laboratory diagnosis, therapy and prognosis, as well as the finer points that need to be considered in regional and congenital syphilis. A section on familial and public health aspects of syphilis is interesting and instructive but not of much immediate value to medical officers on duty with the armed forces.

A distinctly creditable service to syphilology has been performed by the author, by his including an essential working knowledge of syphilis in such a small book.

The photography in the majority of illustrations is excellent. Color plates, paper, printing and binding are above average quality.

METHODS OF TREATMENT, by *Logan Clendening, M. D., Clinical Professor of Medicine, Medical Department of the University of Kansas;* and *Edward H. Hashinger, A. B., M. D., Clinical Professor of Medicine, Medical Department of the University of Kansas;* with chapters on special subjects by *12 contributors.* Eighth edition; 1033 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $10.

It is impossible in this period of rapid advancement in methods of treatment to write a book which will give all the recent changes and present a complete up-to-date treatise on this subject so essential to every practitioner of medicine. Nevertheless, the authors in this new edition have written about as clear and exhaustive an outline of methods of treatment in internal medicine as is possible without making the book too cumbersome.

The use of sulfadiazine as the therapeutic sulfonamide of choice has not been given quite the emphasis it deserves and the use of penicillin is not discussed, however the material undoubtedly was prepared while sulfadiazine was being given the exhaustive trials which proved its superiority and before penicillin had been established as a powerful therapeutic agent.

The arrangement of the material is somewhat different from that in any other book on therapy and some readers may not approve of the

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method of presentation, but in the opinion of the reviewer, it is quite ingenious. In the first part of the book the various procedures such as drugs, diet, hydrotherapy, etc., are discussed, whereas in the second part of the book the results to be expected under the heading of the various diseases are outlined. This arrangement prevents needless repetition because when a certain drug is recommended for the treatment of a disease the reader is merely referred back to the first part where the individual drug has been discussed.

The paper is of the best, the book is excellently bound and the fact that this is the 8th edition indicates clearly its value.

SKIN GRAFTING OF BURNS, Primary Care, Treatment, and Repair, by *James Barrett Brown, M. D., Lieutenant Colonel, Medical Corps, Army of the United States;* and *Frank McDowell, M. D., Assistant in Clinical Surgery, Washington University, St. Louis, Missouri.* 204 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1943. Price $5.

This book contains an excellent brief description of the entire treatment of burns.

Early general care and early local care are well described with special emphasis on open surgical drainage. It is admitted some men still prefer the closed methods of treatment and these are enumerated.

The necessary preparations for skin grafting are described.

The different types of skin grafts are discussed and illustrated and the indications for their various uses are made.

The aftercare of skin grafting is clearly and logically described and good illustrations of final results are shown.

DISEASES OF THE BREAST, Diagnosis, Pathology, and Treatment, by *Charles F. Geschickter, M. A., M. D., Lieutenant Commander, Medical Corps, United States Naval Reserve, Director of The Francis P. Garvan Cancer Research Laboratory;* with a special section on treatment in collaboration with *Murray M. Copeland, A. B., M. D., F. A. C. S., Instructor in Surgery, Johns Hopkins Medical School.* 829 pages with 593 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1943. Price $11.

This book is an exhaustive treatise on the diseases peculiar to the breasts. The author has brought together an amazing accumulation of information on breast pathology. His material has been garnered from the collective experiences of each of the specialties concerned with breast management. Surgery, radiology, obstetrics, gynecology, pathology, endocrinology, and laboratory technology, each has contributed its share to the general knowledge of disease processes affecting the breasts.

Starting with the mammary anlage, the development of the gland is traced in a comparative manner, through the lower orders of mammals until reaching the culmination of development in the intricate mechanism of the human breast. Deviations from the normal in the form of many anomalies and the endocrine pathologico-physiology of

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the breast are next discussed. Mammary hypertrophy, puerperal and nonpuerperal secretion, the various forms of mastitis and the relationship to pregnancy and lactation contribute interesting chapters. Mammary tumors are discussed in the remaining 22 chapters.

There are seven parts to the volume, and in the last three chapters the experimental production of benign and malignant tumors as carried out in the author's own laboratory is described in considerable detail.

Some might take issue with the sequence of chapters and general arrangement of the text. It deviates somewhat from the standard format of similar books. Its heavy paper stock, however, the large print and generous selection of informative cuts and illustrations definitely enhance the value of the book.

The section on operative technic for removal of breast tumors is excellently done and worth perusal by any surgeon contemplating breast surgery.

PICTORIAL HANDBOOK OF FRACTURE TREATMENT, by *Edward L. Compere, M. D., F. A. C. S., Associate Professor of Surgery, Northwestern University Medical School;* and *Sam W. Banks, M. D., Associate in Surgery, Northwestern University Medical School.* 351 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1943. Price $4.25.

The authors of this volume state that it was written for "the conscientious, overworked country doctors and general practitioners, and the medical students who will be treating the injuries of tomorrow." Their efforts have resulted in a very attractive handbook. The style of writing is simple, direct, and the authors' meaning is easily grasped. The numerous pen and ink drawings are well chosen and clearly executed. Undoubtedly the illustrations contribute greatly to the value of the book and to its interest.

The publishers have produced an attractive volume, well bound, easily read, the illustrations clearly reproduced, and the whole format pleasing to the eye.

One who undertakes the writing of a text or handbook on fractures is faced with the task of the proper selection and arrangement of the material to be included. Here it is that this volume is most open to criticism. In a volume intended for the general practitioner and the medical student the inclusion and sketchy description of so many reconstructive procedures is open to question. The general practitioner should never attempt most of these difficult operations.

Modern fracture treatment necessitates the use of wire traction, metal pin fixation, or open reduction and internal fixation in many instances. These authors recommend and briefly describe the use of these special technics for many fractures. The recommendations in general are eminently sound, but the descriptions of the technics are inadequate. The reader cannot safely use any of these special methods

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without consulting one of the larger standard reference works. As neither the medical student nor the country doctor is familiar with the current fracture literature, it is unfortunate that no bibliography is included in this volume.

In their laudable efforts to be succinct the authors have failed in many instances to give the reader sufficient information. For instance, two small printed pages of perhaps 500 words cannot describe fractures of the skull and injuries to its contents in sufficient detail to constitute a satisfactory guide to therapy. In a number of instances the method of treatment outlined by the authors is not the one favored by the majority of the authorities.

A less important criticism concerns the occurrence of colloquialisms and misnomers. The authors apparently use the word adduction when they mean supination (p. 283) and interior in place of posterior (p. 257).

In summary, the book is attractive in format, well illustrated, and eminently readable. Medical students may find it a useful introduction to the subject of fractures, but there is not sufficient emphasis on the basic underlying principles to make it as good a textbook as it might be. The general practitioner will find it useful in helping him to select the proper method to treat a certain fracture, but he will find it necessary to turn to other sources for a detailed description of technics.

A MANUAL OF PULMONARY TUBERCULOSIS AND AN ATLAS OF THORACIC ROENTGENOLOGY, by *David O. N. Lindberg, M. D., F. A. C. P., Lecturer on Tuberculosis, State University of Iowa, College of Medicine; Director of Roentgenology, State Sanatorium, Iowa.* 233 pages; 189 illustrations including 145 plates. Charles C. Thomas, Springfield, Ill., publishers, 1943. Price $6.50.

The book is divided into two parts. Part I is a Manual of Pulmonary Tuberculosis which presents practical diagnosis, treatment, and prevention of pulmonary tuberculosis. It was written especially for the busy practitioner to relieve him from excessive reading. The subject is covered adequately and briefly, and theory, experimental and controversial subjects are not included.

Part II is an Atlas of Thoracic Roentgenology which presents 145 excellent plates of various chest conditions, showing primary type and reinfection type of tuberculosis and progress made during treatment; phrenic nerve paralysis; pneumothorax; pneumonolysis; oleothorax; empyema; thoracoplasty; pneumonectomy; a planigraphic series of 17 plates; and 41 plates on differential diagnosis.

HUMAN GASTRIC FUNCTION, An Experimental Study of a Man and His Stomach, by *Stewart Wolf, M. D., Captain, M. C., A. U. S.;* and *Harold G. Wolff, M. D., Associate Professor of Medicine, Cornell University Medical College, New York Hospital, New York;* with a foreword by *Walter B. Cannon, M. D.* 195 pages. Oxford University Press, New York, publishers, 1943. Price $4.75.

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The authors have tackled a colossal undertaking in gastric physiology. Each individual problem which they worked, is in itself sufficient to occupy a diligent researcher many months. Nevertheless, the authors' contribution to the physiology of the stomach is serious, their experiments carefully executed and observations accurately related. Indeed, their book presents stimulating and interesting reading. The recuperative power of the gastric mucosa which is observed so frequently by gastroscopists was the object of one of their experiments. It is felt by the reviewer to be the most important one. The authors' conclusion that a normal stomach can take a lot of abuse, and an irritated stomach less so, is definitely correct. The publication is expected to produce more rational therapeutic trends in the management of gastric disease.

NUTRITION AND PHYSICAL FITNESS, by *L. Jean Bogart, Ph. D., Formerly Instructor in Medicine, University of Chicago; Instructor in Experimental Medicine, Yale University; Research Chemist, Obstetrical Department, Henry Ford Hospital.* Fourth edition, fully revised and reset. 500 pages with 75 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1943. Price $3.

The fourth edition of this book includes new chapters on vitamins and minerals to cover part of the increase in the literature of this field. In general, the work reflects the teachings of Sherman with great emphasis upon the value of milk and vegetables and subtle opposition to meat in the diet. This book will have no place in the library of the specialist in foods and nutrition but can be read with profit by those who wish to get a general background in the field, without going far into any aspect. As a whole the thinking accords with that commonly taught in modern colleges of home economics. Brief discussions are given of the errors in food fads and the evil effects in modern nutrition of such practices as the consumption of large amounts of sugar in soft drinks.

This text suffers from trying to intermarry the subjects of nutrition with eighth grade physiology. Much of it is rather dull reading. Parts of it are out of date. Much modern nutrition has been neglected. Thus the word "soy bean" is not even found in the index. However, the work can be read profitably by the thousands that are taking refresher courses in nutrition. The illustrations are hackneyed.

ESSENTIALS OF INDUSTRIAL HEALTH, by *C. O. Sappinton, M. D., Dr. P. H., Consulting Industrial Hygienist; President, Central States Society of Industrial Medicine and Surgery; Editor of "Industrial Medicine."* 626 pages with 63 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1943. Price $6.50.

This book is a very timely and well organized text on the important and as yet relatively new field of industrial medicine. It is particularly important today when so much depends on the uninterrupted flow of production from American industry.

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The material is well organized and makes interesting reading. The book is printed with clear type, on a heavy grade of paper, and is well furnished with illustrations and charts.

The chapter on industrial health exposures is very well organized, and presents an excellent classification of such exposure and hazards. The chapter on the plant survey gives an adequate discussion of methods of laboratory analysis and of engineering and medical methods of control of industrial exposures. New problems such as women in industry are dealt with and the discussion on the organization and scope of an industrial medical department will prove to be of value to the reader new in the field. The roll of the industrial physician in maintaining the health of the worker and its effect on production and absenteeism is rightfully stressed. This book is highly recommended and will prove of great value to all those engaged in this field of medicine.

REHABILITATION OF THE WAR INJURED, A symposium, edited by *William Brown Doherty, M. D.*, and *Dagobert D. Runes, Ph. D.* 684 pages; illustrated. Philosophical Library, Inc., New York City, publishers, 1943. Price $10.

This book of 684 pages endeavors to cover all phases of rehabilitation of war injury. This problem is discussed from the neurologic and psychiatric angle, the angle of the plastic surgeon, orthopedist, and physiotherapist. It is also discussed in regard to vocational guidance and occupational therapy with a brief chapter on the legal aspects of rehabilitation.

The articles are written by outstanding authorities in each field both British and American. Much of the knowledge gained by the British in handling these cases since the beginning of the war has been incorporated in this book.

It is an excellent collection of articles with the newest and latest forms of treatment, and an excellent text for a person already skilled in one of the above mentioned fields.

As a textbook for use in training or instruction, it is felt that this book is not satisfactory, as it covers so many subjects in a rather generalized manner without enough illustrations for training purposes.

CLINICAL PARASITOLOGY, by *Charles Franklin Craig, M. D., M. A. (Hon.), F. A. C. S., F. A. C. P., Colonel, United States Army (Retired), D. S. M., Emeritus Professor of Tropical Medicine in Tulane University of Louisiana, New Orleans, La.;* and *Ernest Carroll Faust, M. A., Ph. D., Professor of Parasitology in the Department of Tropical Medicine, Tulane University of Louisiana, New Orleans, La., Consultant to the Secretary of War on Tropical Medicine and on Epidemic Diseases.* Third edition, thoroughly revised. 767 pages; illustrated with 284 engravings and 4 colored pages. Lea & Febiger, Philadelphia, Pa., publishers, 1943. Price $9.

The shrinking of world horizons into time units of hours as well as the global aspect of world war has advanced the study of parasitology

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to a position of major importance. The issuance of the third edition of Clinical Parasitology in its present form of complete revision is not only timely but materially adds to the epidemiologic and clinical literature of diseases caused by parasites. The clear style, the orderly arrangement of subject matter and the large bold print give appeal to the text and alone justify a third writing. The amplifications of sections on diseases transmitted to man by arthropod, the addition of many new tables and illustrations enhance the work and fulfill its purpose as an all round text for the general practitioner, student of medicine, and technician in diagnostic laboratory.

ROENTGENOGRAPHIC TECHNIQUE, A Manual for Physicians, Students and Technicians, by *Darmon Artelle Rhinehart, A. M., M. D., F. A. C. R., Professor of Roentgenology and Applied Anatomy, School of Medicine, University of Arkansas.* Third edition, thoroughly revised. 471 pages; illustrated with 201 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1943. Price $5.50.

The third edition of this book whose previous editions are already familiar to many radiologists, presents a careful revision and expansion of known and proved material. From the technical viewpoint it covers the essential physics adequately and lucidly so that this edition becomes a text for both student technician and instructor. From the roentgenologist's viewpoint it presents the most modern and detailed methods of obtaining films of good diagnostic quality with the part properly positioned and prepared.

The detailed instructions for establishing a workable technic in any laboratory with any type of equipment alone will justify the inclusion of this book in every x-ray library or department. The basic technic is based both on body part thickness and on the varying densities of the human tissues. This is the preferable concept for obtaining proper radiographs. The text draws on the experience of many in this field and thus presents a composite instead of an individual opinion.

The chapter by chapter bibliographies are complete and serve as an excellent guide for further reading in the general fields of radiology and physics and their practical or experimental aspects. This, together with its excellent list of practical demonstrations, makes it especially valuable when a class laboratory is used in the teaching program.

The book is carefully and clearly printed on a good grade smooth finish paper and is pleasingly and sturdily bound. Illustrations and their explanations are generous as to number and excellent as to quality.

THE GENEALOGY OF GYNAECOLOGY, History of the Development of Gynaecology Throughout the Ages—2000 B. C.–1800 A. D.—With Excerpts from the Many Authors Who Have Contributed to the Various Phases of the Subject, by *James V. Ricci, A. B., M. D., Associate Clinical Professor of Gynaecology and*

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Obstetrics, New York Medical College. The Blakiston Co., Philadelphia, Pa., publishers, 1943. Price $8.50.

Someone has said that historians are born, and that it is as impossible to divorce oneself from one's writings as it is to separate oneself from one's shadow.

Too often historians narrate their impressions as facts of history. Such colorings materially detract from otherwise interesting works. It is regrettable that such a beautifully bound volume of excellent printing should contain in many instances impressions narrated as indisputable facts. The historical portrayals of the past as a background for gynecology's genealogy proved to be most disappointing as a true historical narrative. Over-emphasis is placed upon current history, abridging into a secondary place the subject matter of the author's theme. Had the author remained steadfast to the subject and not digressed into polemics of recorded history his work would have been materially enhanced.

The author is to be commended however for the assiduous amount of research such a volume entails and gynecologists will find a sequential story tracing back to some 2,000 years B. C. the genealogy of their chosen specialty.

MEDICAL MALPRACTICE, by *Louis J. Regan, M. D., LL. B., Member State Bar of California.* 256 pages. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $5.

"Prevention is the best, if not the only defense against malpractice." On this premise, the author has prepared a legal handbook for doctors in which the laws relating to the practice of medicine are fully set forth. The text contains an exhaustive study of the malpractice law of all the states. Cases are digested briefly in the text, not merely cited in footnotes as so often is done in works of this type. A table of cases, by states, is included.

In addition to a clear statement of the elements of malpractice, the physician-patient relationship, special rights, liability of doctor, hospital and nurse, the book presents a helpful discussion of questions of evidence—qualification of expert witnesses, expert testimony, the presentation of evidence, etc., which should be of interest to any physician who might be called upon to testify either as witness or party to an action.

This book is nicely bound with a blue cloth binding. The short paragraphs and well-spaced type make for easy reading. It is adequately indexed for ready reference to particular problems, and the table of cases cited is especially helpful in finding the law of any individual state.

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MANAGING YOUR MIND, You Can Change Human Nature, by *S. H. Kraines, M. D.*, and *E. S. Thetford*. 374 pages. The Macmillan Co., New York, publishers, 1943. Price $2.75.

The authors present a "self help" book with a liberal sprinkling of happiness and health thrown in for good measure. It is difficult to determine the group for which the volume was intended. In sections, it seems too involved for the lay reader. Some of the chapters "Achieving Maturity" and "Self-reliance and Courage" would probably benefit the neurotics for whom they no doubt were intended.

In the early chapters "Man vs. Animal," the individual is contrasted with his "progenitors." The next chapter is entitled "Automatic Bodies in a Changing World" and here the authors describe in lay terms the role of the sympathetic nervous system and how it reacts to ordinary every-day phenomena.

The book is entirely too "wordy" and could be cut in half without very much loss. One has to work too hard and wade through too much to get out the good which is contained therein. In places, it is pedantic while in others—it is just plain boring. However, it has promise and maybe something can be done with it at a later date. At present, it is not recommended and, needless to say, it is of practically no interest to the military physician.

LECTURES ON WAR MEDICINE AND SURGERY FOR DENTISTS, edited by *Edward J. Ryan* and *Ethel H. Davis*. 172 pages. Privately printed by the Chicago Dental Society, Chicago, Ill., 1943. Price $3.00.

This is a recapitulation and record of a course of lectures given for dentists to introduce to them the problems of military life as encountered on the world battle fronts of modern warfare today. These topics discussed in the book are valuable to the dental officer not only in the change from private practice to the methods of military dentistry, but also in performing other medical and military duties.

The lectures on topics of modern dentistry such as local and general anesthesia, facial and jaw reconstruction by prosthetic appliances and traumatic surgery of the jaw and their treatment were well presented.

MEMOIR OF WALTER REED, The Yellow Fever Episode, by *Albert E. Truby, Brigadier General, United States Army, Retired*. 239 pages; illustrated. Paul B. Hoeber, Inc., New York, publishers, 1943. $3.50.

General Truby writes of Walter Reed's successful attempt to "convert a discredited hypothesis into an established doctrine." This is the story of a young medical lieutenant's experience during the American occupation of Cuba in some of its medical aspects, principally yellow fever. It is the well known story of the American Army Medical Department's finest achievement in medical research. As such, the "Memoir" has little new to offer.

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But it does portray something of the atmosphere of the scene. With the benefit of hindsight, it provides a peripheral account of the work of the Reed Board and the events in Cuba leading up to it. In this volume—well printed and with some 29 interesting illustrations and an appendix comprising several pertinent Army Medical Orders—there are cleared up several much debated points in the yellow fever saga and a number of new facts are added to its history.

THE UNITED STATES NAVY—A HISTORY, by *Carroll Storrs Alden, Ph. D., Former Head of the Department of English, History, and Government, United States Naval Academy;* and *Allan Westcott, Ph. D., Senior Professor of the Department of English, History, and Government, United States Naval Academy.* 452 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1943. Price $4.

This is a good outline history of our Navy, very suitable for use as an introductory textbook. A great deal of space is devoted to naval engagements, both single ships and fleet actions, and a number of diagrams are provided for the better understanding of them. Another excellent feature is the list of references at the end of each chapter so that the student may readily continue his reading on any subject discussed and expand his knowledge of it without too laborious research. It is of interest to note how many of these references are to the United States Naval Institute, showing the importance of the volumes of the Institute as a repository of American naval history.

Another agreeable feature is the head pieces of each chapter, and the various illustrations are excellent, well chosen and very clearly reproduced.

There is not much to criticize. A little more attention to the logistic side of the naval campaigns, the administrative history of the Navy, the effect of disease in naval history, and perhaps a little more of a biographical touch regarding the leading personalities would have made the work broader and more interesting. There is a good index. The cover of navy blue is appropriate and attractive.

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HEALING TIME OF SULFONAMIDE OINTMENT

Local use of an ointment containing sulfonamide compounds in 5 percent concentration did not accelerate the healing of superficial or deep incised or trephine wounds of the cornea of rabbits if sterile instruments were used to produce the injury. The ointment was of value in the treatment of wounds produced with instruments that were infected with Staphylococcus aureus haemolyticus.—Berens, C.; DeGara, P. F.; and Loutfallah, M.: Effect of sulfonamide ointment on healing of experimental wounds of rabbit cornea. Arch. Ophth. **30**: 631–644, November 1943.

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RESPONSE OF ACUTE POLIOMYELITIS TO LARGE DOSES OF PLASMA

During the spring and summer of 1943 an epidemic of poliomyelitis occurred in the Hawaiian area. Five acute cases with typical history and physical and spinal fluid findings were admitted to a naval hospital.

The first patient was flown to the hospital from an outlying island. He was semicomatose, with stiffness of the neck, reflexes absent, incontinence, and paralysis from the waist down. Two spinal taps were attempted without results except for two or three drops of fluid. It was believed that the reason for the failure to obtain adequate fluid for study might be extreme edema of the cord with occlusion of the canal. A cisternal puncture was done, fluid secured, and typical findings demonstrated.

No convalescent pooled serum was available, and it was thought that dried plasma might contain antibodies in sufficient quantity to be beneficial if given in large doses. Consequently 1,250 cc. was given immediately and 1,000 cc. later the same day. The response was spectacular. Within 24 hours the patient became rational, and some movement of the extremities was noticeable. Hot wet packs were applied to the extremities with frequent changes as indicated.

In a few days all reflexes had returned, movement of all muscle groups was present, and the patient wanted to get out of bed. Two additional doses of 500 cc. of plasma were given and in a few weeks he was returned to duty without evidence of residuals. The remaining four cases, which were received within 1 to 4 days after the acute onset and all of which were severe, were treated in a similar manner with the same results. * * * Three additional severe acute cases have recently been seen and treated with massive amounts (1,500–2,500 cc.) of plasma with the same response. A total of eight consecutive acute cases have been treated in this manner. Their degree of infection was extensive, as manifested by the clinical picture, and there have been no residuals.

This preliminary note is presented as an interesting observation. No explanation is offered. Further studies are in progress.—Barnum, G. L., Lieutenant Commander (MC) U. S. N. R., and Bower, A. G., Commander (MC), U. S. N. R.

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PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

TRINITROTOLUENE (TNT) POISONING

THOMAS E. CONE, JR.
Lieutenant (MC) U. S. N. R.

Due to the great increase in the number of persons engaged in the handling of trinitrotoluene (TNT) and because of the necessity of frequently employing untrained ordnance help, prevention of toxicity from this source becomes an increased problem. The seriousness of many of the toxic symptoms makes it most important that early signs of poisoning be recognized by both clinical and laboratory means.

TOXICITY

TNT is pale yellow in color, almost without odor. It is soluble in acetone and melts at 81° C. Of the six possible isomers it is the 2:4:6 or "symmetrical" variety which makes up the largest amount of crude commercial TNT.

In an effort to study its toxicity Moore (*1*) in 1917 demonstrated the channels of absorption and the methods by which this absorption could be combated. He showed that the skin is the most important channel of absorption. If the skin can be properly protected, therefore, absorption can be greatly reduced.

The early signs of toxicity are usually fairly well defined. The most frequent symptoms reported by our employees were epigastric pain, headache, tightness of the throat and chest, dyspnea, nausea, anorexia, and general malaise.

A complete physical examination should be performed whenever a TNT handler consults the medical officer because of illness. Especial care should be exercised in the search for jaundice of the sclerae and for pallor and cyanosis of the mucous membranes. Jaundice and anemia are the two signs of imminent danger. During World War I toxic jaundice affected about 2 percent of all TNT workers, and of these the mortality rate was 25 percent.

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Jaundice.—Even the slightest degree of jaundice in the TNT worker must be considered as a toxic manifestation unless proved otherwise. These patients must be hospitalized.

Jaundice in TNT runs a rapid course and not infrequently progresses to an acute yellow atrophy of the liver. The changes are due to some form of toxemia which damages the liver cells producing subsequent autolysis and destruction. The jaundice apparently follows degeneration and the consequent obliteration of the bile capillaries.

At autopsy the liver appears greatly reduced in size, with a wrinkled surface. The color is yellow green and in some areas appears dark red. The lobular markings are quite indistinct. The liver feels soft to the touch and frequently is quite friable.

The symptoms usually can be divided into two stages. At the first stage, or onset, the symptoms are those of catarrhal jaundice, and do not indicate the seriousness of the condition. The medical officer must hospitalize the TNT handler at this early stage. The second stage is usually a rapidly fulminating acute yellow atrophy of the liver.

Blood changes.—It is imperative that complete blood counts be done on TNT workers at regular intervals. A pre-employment count should be on record for purposes of comparison. A fall in the hemoglobin value or in the number of erythrocytes is of extreme importance.

A leukocyte count of 15,000 to 18,000 has frequently been noted about 2 weeks after the worker's employment. This leukocytosis is only transitory, however, and is probably due to an initial stimulation of the hematopoietic system. The same transient rise has occasionally been noted in the case of erythrocytes. About 60 percent of the employees here demonstrated this early transitory leukocytosis and/or erythrocytosis (*2*). Any decrease in the formed elements of the blood should be construed as serious, and the individual withdrawn from the TNT plant. Monfort-Sales (*3*) has recorded a very complete study of the early effects of TNT on the blood.

Dermatitis.—The dermatitis produced by TNT is largely a seasonal complaint, being most troublesome during the hot weather and at a minimum during the winter. If the worker is wearing the usual protective clothing, the initial lesion is usually noted on the exposed hands and forearms. The first lesion begins with a superficial erythema which soon shows vesiculation. A frequent location of the dermatitis is between the fingers and the free edges of the palms where sago-like vesicles are noted. The irritation is often intense and occasionally, in severe cases, an exfoliative dermatitis may develop. It has been our experience that the majority of workers developing dermatitis from TNT develop an increased tolerance and after recovery from the dermatitis can resume work with no subsequent difficulties. Schwartz and Goldsmith (*4*) recently described a protective ointment

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(formula D) which will be found of great help to those who are unusually sensitive.

FORMULA D

	Percent
Shellas	13.20
Isopropanol	30.96
Linseed oil	4.66
Titanium dioxide	12.03
Sodium perborate	12.03
Sodium bicarbonate	3.09
Talcum powder	21.94
Carbitol	3.09

Dissolve the shellac in isopropanol; mix the solids in a cooled mixer to prevent the elimination of oxygen from the perborate; add the linseed oil and carbitol. Mix again. Then add the alcoholic solution of shellac, and mix again. All the mixing is done in a cooled kettle.

Cyanosis.—This is produced because TNT causes the hemoglobin to be converted into methemoglobin. The presence of cyanosis is a warning signal, and all employees so affected should be removed from contact with TNT.

PREVENTION

Prevention of TNT toxicity may be effected by observing the following:

Types of individuals to be employed.—The British and American experience has clearly demonstrated that workers below the age of 18 years are particularly susceptible to poisoning. They therefore should not be engaged. All investigators have shown that the dark-skinned individual is far less susceptible than the fair-skinned type. Chronic alcoholics, dyspeptics, and asthmatics should not be hired because of their poor tolerance to TNT.

Hygienic facilities.—The plant should be equipped with adequate toilets, wash basins, and showers. A clean, well-ventilated lunchroom should also be provided.

Since, as was mentioned earlier, TNT is absorbed largely through the skin, the importance of daily shower baths becomes apparent. The shower room should be located so that each employee will have to pass through it after discarding his work clothes and before donning his street clothes. Every employee should be provided with a clean work suit, cap, and underwear every day.

The complete removal of TNT from the skin is quite difficult with the ordinary soaps. Norwood (5) has suggested a liquid soap which removes TNT from the skin very effectively. To impress upon the workers the inadequacy of washing with the usual soaps a skin Webster test is done. The reagent is made by adding one part by volume

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of saturated stock solution of sodium hydroxide in absolute alcohol to nine parts by volume of absolute alcohol. The action of the test is due to the fact that when alcoholic sodium hydroxide reacts with TNT a purple color is produced. After a thorough washing, a little of the reagent on a piece of cotton is rubbed over the skin and the surprised worker notes the purplish stain produced by the TNT which the soap has not removed.

The special soap is in liquid form to which is added 5 to 10 percent of potassium sulfite and 5 to 15 percent of an appropriate wetting agent.[1]

Determination of TNT in air.—This is a very important item in the scheme of prophylaxis, for no matter how elaborate the hygienic facilities are, they will be of little value if the concentration of TNT in the air is above the threshold level by the Kay method. This procedure was previously described (*6*).

Routine check on all employees.—The weekly performance of the Webster urine test (*7*) on all persons engaged in the handling of TNT is a valuable procedure, as it permits an examination of each employee every week and thus detection of early cases of jaundice, skin pallor, cyanosis, and dermatitis is insured.

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[1] Information concerning companies making the special soap described by Norwood may be obtained from the office of Col. W. J. McConnell, Medical Corps., Office of the Chief of Ordnance, 333 North Michigan Avenue, Chicago, Ill.

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CONSTRUCTION VENTILATION OF SHIPS

MARION T. YATES
Lieutenant Commander (MC) U. S. N.

By construction ventilation of ships is meant the ventilation required in order to permit ship construction to proceed without delay. It does not refer to the ventilation which is a structural part of the ship.

Construction of ships in the south offers two major problems; first the exhausting of welding fumes from compartments and second, the removal of excessive heat from compartments during the summer months, thus providing an atmosphere in which employees may carry on their work in a fair degree of comfort. This excessive heat arises from various sources, chief among them being (1) the local climate, (2) compartments below deck in which there is practically no air movement normally, (3) heat radiated from construction processes such as burning and welding, and (4) the heat radiated from many human bodies in a confined space.

No attempt is made to estimate the number of employees exposed to welding fumes at this navy yard. However welders are exposed daily to the purely industrial illness of metal fume fever. Table 1 lists the number of cases occurring during the past year. It is interesting to note that all cases of metal fume fever occurring since September 1942 were in instances where welders were in a hurry to finish jobs and did not request exhaust ventilation at their places of work.

TABLE 1

Year and month	Number of cases of metal fume fever	Illness ratio [1] in percent
1942—April	9	0.50
May	5	.31
June	2	.13
July	5	.31
August	0	0.
September	1	.0063
October	2	.13
November	1	.006
December	0	0.
1943—January	0	0.
February	0	0.
March	0	0.
April	1	.006

[1] Illness ratio based on known exposures only compared to the number of persons ill. It does not include other workers in the vicinity of welders who are exposed daily, as their number is variable and cannot be determined with any degree of accuracy.

Illness from metal fume fever has been reduced to a minimum due to several factors which are the primary concern of three individuals whose jobs are briefly as follows:

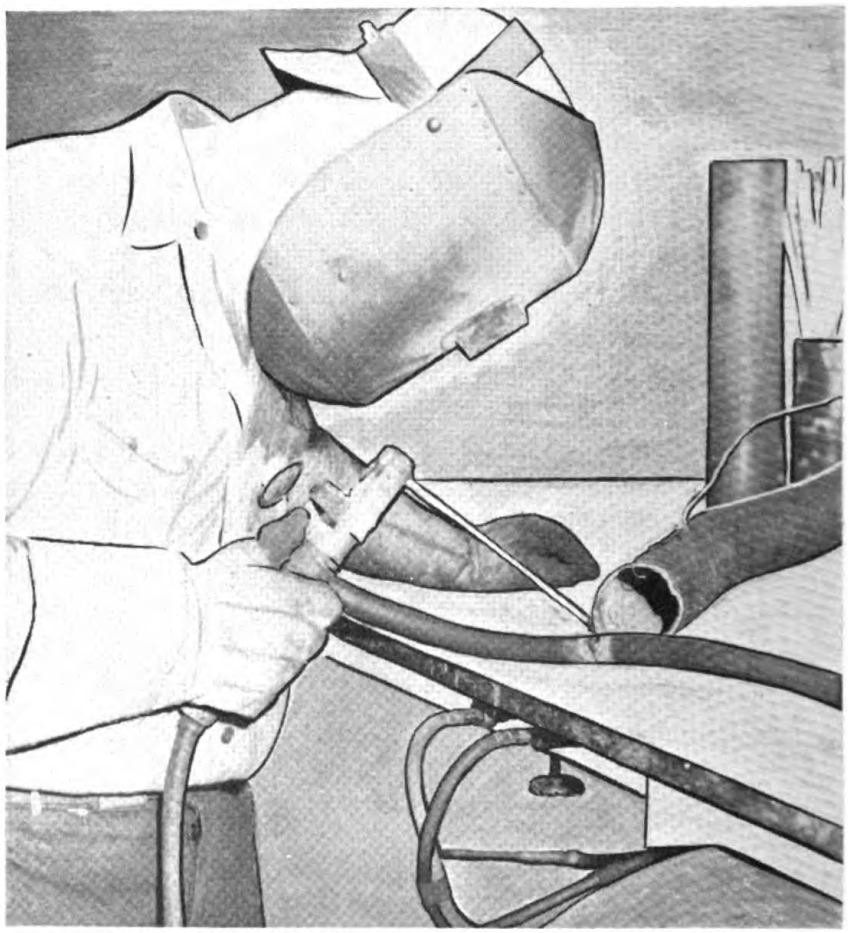
1. The safety officer who investigates each case of metal fume fever to determine its cause and to learn why exhaust ventilation was not in effect.

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2. The industrial medical officer who examines every worker alleged to have metal fume fever. He also makes frequent checks of the efficiency of exhaust systems in use.

3. The quarterman sheetmetal worker in charge of the ventilation department whose job it is to provide adequate exhaust ventilation.

Each welder is protected by an individual flexible metallic hose (fig. 1) connected to an exhaust fan by which the fumes are removed at their source and drawn off to the outside atmosphere. We have found hoses of 3- and 4-inch diameter to be the most practical.



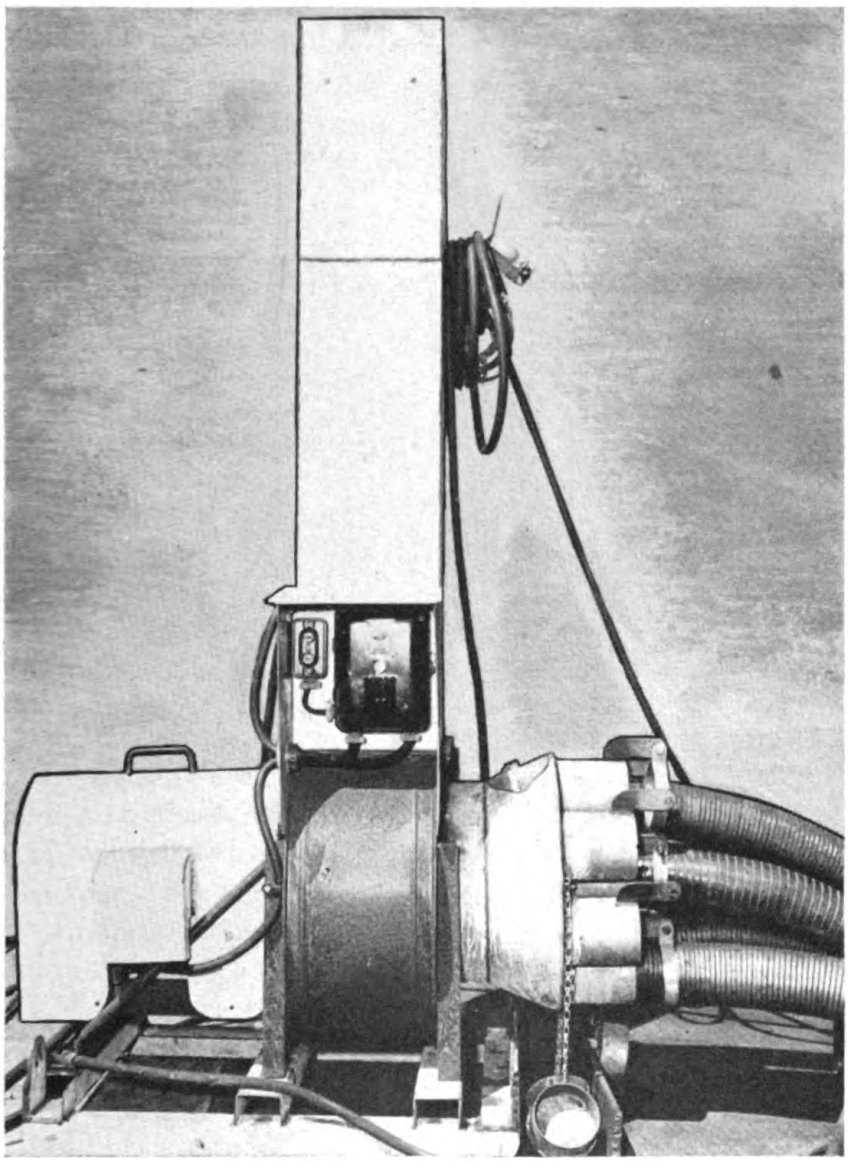
1. Fumes are being drawn off at point of welding.

The mere presence of an exhaust hose in a compartment, however, is no assurance of effective fume removal. For its most effective use the exhaust end of the hose must be as close to the welding job as possible. Regardless of the cubic feet per minute of air exhausted the effective safety zone is measured in inches. Tebbens and Drinker[1] recommended a minimum air velocity for local exhaust of welding operations of from 75 to 125 feet per minute. Their experiments were

[1] Tebbens, B. D., and Drinker, P.: Ventilation in arc welding with coated electrodes. J. Indust. Hyg. & Toxicol. **23**: 322–342, September 1941.

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conducted using rods of $\frac{5}{32}$ to $\frac{5}{16}$ inch and a hose with a diameter of 3 inches. Time and additional experience have indicated that these values are low for welding in ship construction. It is generally agreed at the present time that an airflow of 250 to 300 cubic feet per minute is the most economical and efficient. Such an airflow provides an adequate safety zone of 9 to 10 inches.[2]



A portable 8-way exhaust blower.

Figure 2 shows one of the portable 8-way exhaust blowers in use. The base, the removable motor housing on the left, the 8-way connections to individual metal hose, the protective shield for switch and fuse box, and the exhaust stack with hook for plug-in line were con-

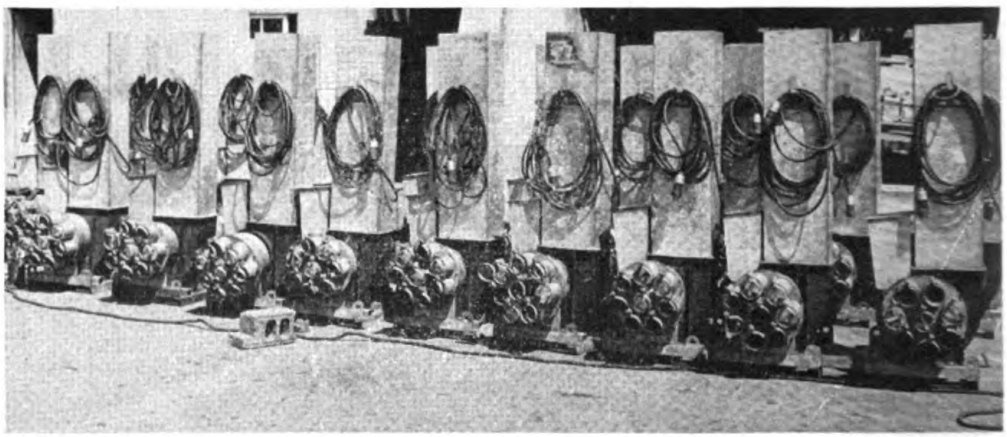
[2] Molloy, C. B.: Hull Ventilation in Shipyards. Bulletin 4301, General Blower Company, p. 3.

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structed here. The method of connecting the flexible hose to the exhauster and the metal caps to cover inlets not in use are shown. This unit was assembled by the ventilation department. The specifications on this exhaust fan are:

Capacity	3,300 CFM
Horsepower	5
Volts	220–440
R. P. M	1,740

Figure 3 shows a battery of these 8-way exhausters from another angle. The advantages derived from attention to such small details as the hook for plug-in line in constructing these units is clearly shown.



3. A battery of 8-way exhausters.

In selecting an exhaust fan too much reliance should not be placed on its rated delivery capacity in terms of free air or assumed static pressure. The actual airflow at the welder's end of the duct is the one important factor in determining the effectiveness of an exhaust fan in performing its job; namely removal of welding fumes at their source. Table 2 shows the effectiveness of this unit at various distances from the fan. These figures are representative measurements with the three different types of exhaust heads in use.

It is important to keep in mind that table 2 is based on airflow at the welder's end of the hose. The figures given are representative measurements taken at distances indicated from the fan exhaust. The actual airflow can be checked by a Pitot tube or U-tube water gage applied about 6 inches from the duct end. A 3-inch vane anemometer may also be used, and if calibrated against the U-tube water gage or Pitot tube, measurements are quickly and easily made. The vane anemometer is used here on routine rechecks of the exhaust system. Tests of this kind are valuable for the following reasons:

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TABLE 2

Distance from exhaust fan in feet	FPM	CFM	Size of exhaust duct in inches	Area of exhaust duct in square feet	Safety zone in inches
5-way exhaust head:					
30	5,255	258	3	0.04909	9
30	5,092	250	3	.04909	9
30	5,176	254	3	.04909	9
60	3,361	165	3	.04909	7
60	3,463	170	3	.04909	7
60	3,504	172	3	.04909	7
8-way exhaust head:					
30	2,920	254	4	.08726	9
30	2,950	257	4	.08726	9
30	3,010	262	4	.08726	9
40	2,500	218	4	.08726	8
40	2,610	227	4	.08726	8
40	2,550	222	4	.08726	8
50	2,090	182	4	.08726	7.5
50	2,210	192	4	.08726	7.5
50	2,000	174	4	.08726	7.5
60	1,995	174	4	.08726	7.5
60	2,000	174	4	.08726	7.5
60	1,890	165	4	.08726	7
10-way exhaust head:					
30	3,246	283	4	.08726	9.5
30	3,300	287	4	.08726	9.5
30	3,268	285	4	.08726	9.5
60	1,819	159	4	.08726	7
60	1,895	165	4	.08726	7
60	1,850	161	4	.08726	7

1. Help maintain worker morale; the men know that equipment furnished for their protection is checked and rechecked at frequent intervals.

2. Discourage feigned illness.

3. Enable those charged with the care of the equipment to maintain it at peak efficiency.

4. Useful in safety education. Stress keeping the point of the weld on the centerline of the hose mouth and the hose end within the known safety zone (depending on exhaust fan and length of hose).

5. Remove the guesswork from exhaust ventilation and put it upon an easily workable and practical basis.

Figure 4 shows the fan housing made in the yard for use over hatches. This housing is constructed of wood covered with corrugated galvanized metal in order to use as little metal as possible in its construction. The specifications of the fan are as follows:

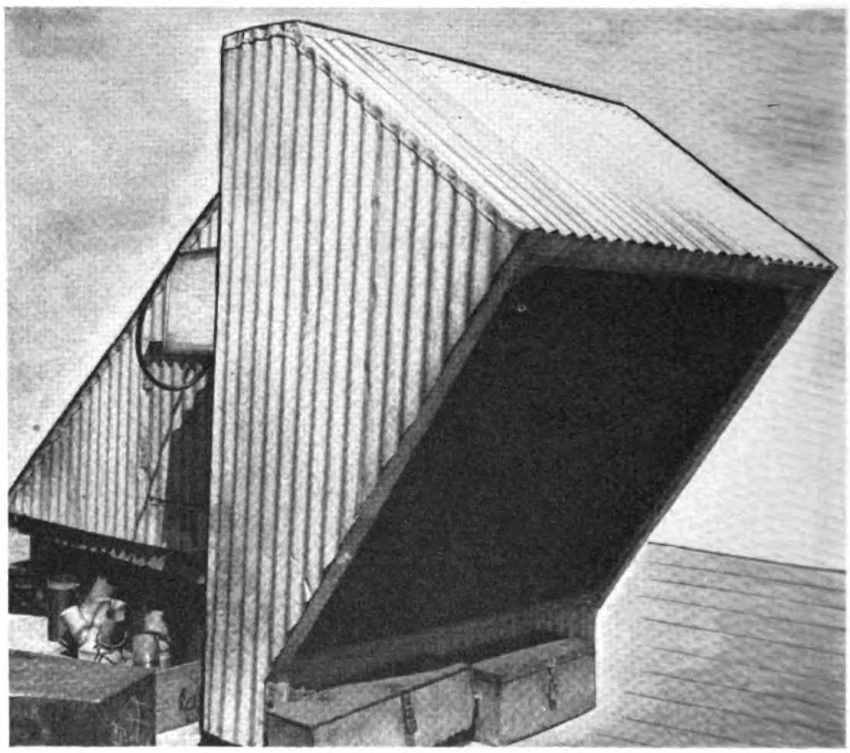
Capacity	38,000 CFM
Horsepower	2
Volts	220–440
R. P. M.	1,740

When first employed it was used to blow fresh air into the fore and aft compartments in order to cool the working environment below decks. Ventilation of this type is essential in the south during the summer months if workers are to be kept below the main deck for long periods of time. This unit was not entirely satisfactory when used as a blower and the fan was therefore reversed in its housing

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so that it would work as an exhaust unit. This resulted in marked improvement in its cooling capacity.

Actual measurement of compartment air temperature in July of last year was 135° F. With one of these fans installed over the fore and aft hatches of a destroyer the temperature in the same compartment on the same day dropped in four hours to 90° F. Thus below the main deck a relatively comfortable working environment was provided. This particular type of ventilation is used only for its cooling effect.



4. Fan housing for use over hatches.

When the yard began to expand during the present emergency the manager and production officers wisely incorporated exhaust ventilation in the construction of new building docks. Each building dock is served by four exhaust blowers of 15,000 CFM each. The specifications on these exhaust fans are:

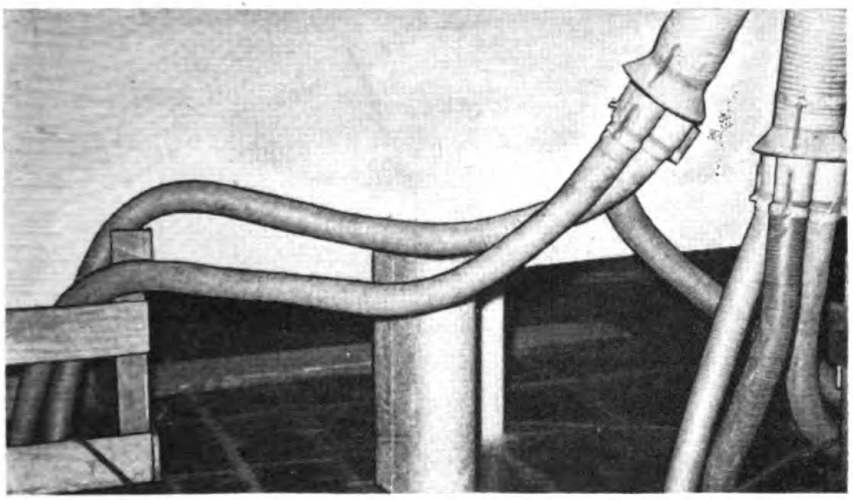
Capacity	15,000 CFM
Horsepower	20
Volts	440
R. P. M	1,740

Each main duct has 44 6-inch duct connections per side. Airflow through each 6-inch duct connection is remarkably constant for the entire main duct, varying from 10,700 to 9,800 feet per minute. Each horizontal main duct is 26 by 28 inches, and each vertical exhaust stack

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aft of the motor is 26 by 36 inches. There are 30 feet of 6-inch flexible metal hose connected to each opening in the main horizontal duct.

Figure 5 shows the method of connecting three 3-inch flexible metal ducts to the terminal 6-inch duct. These connections are constructed



5. This shows the method of connecting three 3-inch flexible metal ducts to the terminal 6-inch duct.

in the yard. Table 3 shows the effectiveness of this permanently installed system of exhaust ventilation when measured at the welder's end of the duct at distances of 60 and 90 feet from the main horizontal duct.

TABLE 3

Distance from main horizontal duct in feet	FPM	CFM	Size of exhaust duct in inches	Size of exhaust duct in square feet	Safety zone in inches
60	4,400	216	3	0.04909	8
60	4,430	217	3	.04909	8
60	4,420	217	3	.04909	8
90	1,950	96	3	.04909	6
90	1,720	84	3	.04909	5
90	1,860	91	3	.04909	6

Another type of exhaust blower for which use has been found in the yard is a portable blower. The specifications on this exhaust blower are:

Capacity	550 CFM
Horsepower	1
Volts	220
R. P. M	3,450

This exhaust blower employs two 3-inch flexible metal ducts and works efficiently up to 30 feet. Its greatest advantage lies in the fact that it is light in weight and can be moved and installed at a new location by one man; cranes are not needed to move the blower as is

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necessary with the other types of ventilating equipment. Other advantages are that the motor is of only 1 horsepower, which makes for a low operating cost, and the compactness of the unit where space is at a premium even on men-of-war during the stages of construction. The greatest disadvantage of this exhaust blower is that it does not hold up under continual use of 24 hours each working day. But it is particularly valuable on short emergency jobs because of the ease and quickness with which it can be installed and put into use. Table 4 shows the effectiveness of these exhaust blowers.

TABLE 4

Distance from exhaust fan in feet	FPM	CFM	Size of exhaust duct in inches	Area of exhaust duct in square feet	Safety zone in inches
25	2,705	132	3	0.04909	6.5
25	2,800	137	3	.04909	6.5
25	2,757	135	3	.04909	6.5
50	1,654	81	3	.04909	5
50	1,614	79	3	.04909	5
50	1,671	83	3	.04909	5

It has been found advisable to keep the safety zone at 8 to 9 inches. Where possible this has been insisted upon, even if larger exhaust blowers must be used. If the safety zone is reduced much below this figure one of two things will occur: The welder in attempting to keep his point of weld within a narrow safety zone will spend 50 percent or more of his time placing and adjusting his end of the flexible metal hose thereby decreasing his production output. Or he will ignore his safety zone in an effort to keep his productive effort at a maximum, with the result that he and other workers in the compartment report to the dispensary for treatment of generalized body aches and pains or typical full blown cases of metal fume fever. As a result the productive output of the offending welder and those around him suffers, due to lost time.

The following details aid in keeping repairs to a minimum and at the same time result in maximum ventilation efficiency:

1. All exhaust blowers are equipped with screen guards of ½-inch mesh galvanized wire to prevent rags and trash from entering the fan housing.

2. The ventilation department consists of 86 sheetmetal workers and helpers, with a quarterman sheetmetal worker in charge. The individual in charge of this department is experienced in exhaust ventilation. It has been found that one man can take care of about 10 exhaust blowers. This varies somewhat, depending upon the frequency with which it is necessary to move them.

3. The ventilation crew all wear regulation fiber helmets with a large V painted in white on the front and back of the helmet so that

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other workers may easily identify these men when ventilation is needed on a job.

4. All exhaust blowers are in the custody of the sheetmetal shop. It is charged with the upkeep and repair of all ducts and flexible tubing.

5. Sheet-metal workers charged with ventilation are on the job during all shifts. It is their job to install, locate, connect fittings, and to clean out exhaust blowers. They record the serial number of all exhaust blowers going aboard ship. This is done to give a constant record of the location of each blower in the yard, so that none may be lost.

6. The electric shop is charged with the weekly inspection and greasing of all electric motors and fans.

7. No one but the ventilation crew is allowed to touch the exhaust blowers. This rule is strictly enforced to avoid excessive breakage and repair. No blower has broken down here during the past year.

8. The only exception to No. 7 is that the welder is allowed to move his end of the flexible duct so that his point of weld is always within the safety zone.

GASES IN SUNKEN AND DAMAGED SHIPS

CHARLES M. PARKER
Commander (MC) U. S. N.

During the attack on Pearl Harbor several ships were damaged in a sewer-polluted section of the harbor, permitting water to enter the holds. During the process of salvaging, a test cap was removed followed by air escaping from the closed compartment into a trunk where the man removing the test cap was standing knee deep in water. A minute or two after the cap was removed he fell, and those above, thinking he had fainted and not realizing a hazard was present, dashed down to his rescue. The immediate results were one dead, one dying, and four seriously ill. The four finally recovered while the critically ill patient lived 2 days and died of hypostatic pneumonia. Examinations of the blood on admission showed nothing abnormal. Carbon monoxide had been suspected but with it ruled out, the cause was somewhat obscure.

The trunk in which the disaster occurred had been closed following the tragedy, so it was possible to obtain samples of the air and reclose the compartment. The samples were unfortunately collected in clear 1-gallon jugs and allowed to stand in the sunlight for a few hours. When tested at the laboratory there was no hydrogen sulfide present.

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Later samples collected in brown 1-gallon jugs and analyzed immediately showed hydrogen sulfide in excess of 1,000 parts per million. The properties of hydrogen sulfide are as follows: Colorless, heavier than air, and at a low concentration has the odor of a rotten egg, while at a higher concentration it has a sweet odor. Hydrogen sulfide has no odor in a concentration of 1,000 parts per million and higher; in addition to which concentrations of 700 parts per million may paralyze the nerves of smell.

The maximum safe quantity of gas in the air where people are to work without masks is 20 parts per million. A concentration of 700 parts per million is sufficient to cause death in a short time, whereas a concentration of 1,000 parts per million may cause death instantaneously. Below these concentrations varying effects may be noted.

The symptoms are: Irritation of the mucous membrane of the eyes, nose, and the respiratory tract; burning of the throat, and general signs of a cold or a bronchitis; headaches and dizziness; gastrointestinal disturbances; easy fatigability, slow pulse, irritability, and certain psychic disorders, such as temporary inability to concentrate.

In the material used for the basis of this paper, the concentration of hydrogen sulfide gas encountered in the air was as high as 10,000 parts per million, and total sulfides in the water, 300,000 parts per million. This gas seemed to be the first found in any quantity; however as the work progressed carbon monoxide, carbon dioxide, gasoline vapors and methane were encountered in addition to the hazard of oxygen deficiencies.

For the first few days the only equipment available for detecting the presence of hydrogen sulfide was lead acetate paper. Later samples were collected in brown 1-gallon jugs and analyzed at the laboratory.

Since hydrogen sulfide is heavier than air the means for its removal was obviously suction ventilation. When the gas and water were removed the contents of the compartments were noted. In all cases when hydrogen sulfide was in excess of 1,000 parts per million, clothing or cardboard boxes were found in the compartments. Later experimental work showed that water clear of hydrogen sulfide in half-filled, well-stoppered brown bottles containing small pieces of cardboard showed total sulfides of approximately 300,000 parts per million in 3 weeks. While spore-bearing microorganisms were found in the water, spirochetes, one long and one short, predominated. So far we have not been able to culture this spirochete.

Another vessel showed hydrogen sulfide in the air up to 10,000 parts per million and total sulfides in the water up to 275,000 parts per million. Carbon monoxide was present up to 3,000 parts per million. Explosive gases were high in the vicinity of gasoline storage as would

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be expected; however in other areas the explosive was found to be methane.

Suction ventilation and close checks on the compartments, leaving signs to show the hazards, together with instructions to men working on the ship prevented further casualties. Suction ventilation was from the lowest point and delivered over the leeward side of the ship to the water for discharge. Oxygen rescue breathing apparatus, face plates, with the air supply from the topside, or deep-sea diving suits were used to protect those testing or working in an area contaminated by unsafe concentration of any of the gases. Those without such protection were not allowed in unsafe areas.

Measures adopted for protection of the men were as follows:

At least two men must work together or very near each other at all times for mutual assistance while a task is being accomplished.

The explosive meter is first used to test for explosive gases, the hydrogen sulfide detector is second, followed by the carbon monoxide ampule (palladium chloride). It must be remembered that hydrogen sulfide will turn the ampule covering black, so if hydrogen sulfide is present in any concentration, another carbon monoxide detector (iodine pentoxide) must be used. If hydrogen sulfide is absent, however, the palladium chloride ampule is valuable and easy to use.

Assuming there are no explosive gases, no carbon monoxide or hydrogen sulfide, the safety lamp is used and if the flame is normal, that compartment is considered safe. Ventilation (suction) is always recommended, however, to reduce the prevalence of foul odors found in these ships.

Cleared areas must be rechecked at least twice daily and also when the ventilation is shut down and restarted. No one is allowed in unsafe areas unless wearing an oxygen mask or its equivalent. No shallow-water helmets are permitted.

All data are collected and tabulated on a special central gas board from which it is possible to follow the entire procedure of decontamination.

In this type of work four to six men are teamed constantly and return every few hours to the gear locker to report and to compare findings.

GENERAL RULES FOR TESTERS IN DEGASSING SHIPS UNDER SALVAGE

1. Always work in pairs—never let one man work alone.
2. Mask and oxygen bottles must be kept clean of oil and grease at all times.
3. Keep constant check of soda lime in rescue breathing apparatus.
4. Instruct men in general regarding gases, and why sampling is to be exact and thorough. Then train them in interpreting results.
5. Give men general plan of salvage and be sure they open no compartments unless requested to do so by the salvage officer.

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6. Open test cap and take a sample, then if the door is to be opened, the salvage officer will give the instructions.

7. It can't be emphasized too much, that the primary object is to raise the ship and all must cooperate with salvage officer at all times. He, and he alone, should say what will be opened and what left closed.

8. Never take chances: *Only one slip and men die.*

9. Use ventilation (section) for heavier-than-air gases.

10. Dewater even small places and small quantities.

11. Clear up contaminated compartments as soon as possible after opening, thus preventing the gas from spreading through the ship.

12. Suspect gas in areas containing clothing or paper (particularly cardboard boxes).

13. Use oxygen mask, diving (deep-sea) suits, face plates with air source from clean air, as protection for testing people or those having to work in contaminated atmosphere.

14. Don't let crew live on ship until gas is cleared.

15. Good hot meals are essential for men working on the ship.

16. One day in four off the ship (all men).

17. Definite working hours for each shift.

18. Definite section to clear given definite division, holding officer responsible, and requiring him to supervise men at the spot.

19. Clean up ship in general systematic form, from above downward.

20. Have a ship's plan at officer-of-the-day booth showing safe and unsafe areas of the ship. Executive officer should require officers to make frequent checks of the plans.

THE FOLLOWING CONCLUSIONS DEDUCTED FROM SALVAGING SHIPS IN PEARL HARBOR, T. H., SHOULD BE OF HELP TO FUTURE MAJOR SALVAGE WORK

1. When ships were sunk in waters polluted by sewage, toxic gases were formed which were dangerous to personnel salvaging the vessel.

2. Hydrogen sulfide was the lethal gas found on these ships. A concentration of 1,000 parts per million may kill in a few minutes, lesser concentrations are hazardous to health.

3. Carbon monoxide was found, but not in the blood of any patient sent to the hospital following the catastrophe on the first ship.

4. Each compartment should be tested for toxic gases unless the man entering is protected by an oxygen rescue breathing apparatus and a deep-sea diving suit or its equivalent (never an all-purpose mask or regular gas mask).

5. The cause of this gas at present is somewhat obscure. Experimental work going on at this time will undoubtedly give the explanation at a later date.

6. It is imperative that the salvage officer lay before the ship's officers and those handling the toxic gases his general plan of salvage, so that all will understand the necessity of complete coordination and cooperation with him.

7. Those handling the problem of removing the toxic gases must be familiar with the general plan of the ship and the contents of each compartment. So far, wherever Supply Department stores have been found on damaged ships in Pearl Harbor, hydrogen sulfide has also been found.

8. The most important thing is to use suction ventilation whenever these gases are found. This ventilation should be discharged over the side of the ship as near to the water surface outside the ship as possible.

9. Whenever the gas is found the contents of the compartment should be removed as soon as possible after the compartment is opened, to prevent the gas from spreading to other areas.

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10. An apparatus for administering 95 percent oxygen and 5 percent carbon dioxide should be available for rescue work.

11. People testing for gases should be equipped with a rescue breathing apparatus and suitable clothing and boots to cope with the oil, muck, and mire encountered in this type of work.

EQUIPMENT NECESSARY TO KEEP A CHECK ON GASES FOR FOUR MEN (TWO TEAMS)

2 Explosimeters and 25 feet of hose with couplings.
2 Hydrogen sulfide detectors.
144 Hydrogen sulfide detector tubes.
500 Carbon monoxide detector ampules (palladium chloride). ([1]) Lead acetate (10 percent) paper, fresh every 2 weeks.
10 One-gallon brown glass jugs with rubber stoppers and two glass tubes, one to bottom of jug, the other just through stopper—add rubber on top with clamps. For collecting gas use water in bottles.
12 Large-mouth quart bottles and rubber stoppers.
4 Oxygen masks, complete face coverage, complete with wrenches.
24 Oxygen bottles and canvas bags to carry bottles.
4 Safety lines.
2 Safety lamps.
12 Sampling tubes, flask, 500-cc. or larger.
12 Rubber bulbs, 100-cc. with check valves.
([1]) Laboratory equipment for quantitative analysis.
6 Head lamps.
6 Flashlights, batteries, and bulbs.
12 Pairs of gloves.
4 Pairs of knee boots.
2 Waders (rubber).
32 Tank suits or coveralls with several pockets.
([1]) Rags, plenty.
([1]) Carbon tetrachloride and alcohol.
1 Plan of ship.
2 Bottles of potassium starch iodide paper.
([1]) Adhesive tape.
([1]) Salt tablets.
1 Thermometer.
([1]) Diesel oil.
50 Pounds of soda lime.
([1]) Tincture of green soap.
12 Signs (GAS—STAY OUT) 1 foot square.

[1] Quantities to be determined by the size of the job and how much time is available.

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AMBULATORY TREATMENT OF SOME COMMON TYPES OF INDUSTRIAL INJURIES AND FRACTURES

EARL C. CARR
Captain (MC) U. S. N.
and
ADRIAN L. LEE
Lieutenant (MC) U. S. N. R.

In this Naval activity practically all types of bone injuries are encountered. Here thousands of skilled laborers are employed, and in spite of well regulated and well supervised safety engineering methods, the work is hazardous and many accidents occur. Formerly the conservative type of treatment instituted resulted in the loss of many man-hours. This loss has now been greatly reduced.

The injuries most frequently encountered are fractures of the extremities. Fractures of the toes are particularly common wherever there is work of a heavy nature, the great toe being the most often injured. Fracture of this digit is usually accompanied by superficial soft tissue injuries. Very little displacement or angulation of the bony fragments has been encountered, since mashing and crushing types of trauma are usually involved.

The patient with fracture of the great toe is given sick leave for a period rarely exceeding 5 days, when he is instructed to return for daily dressings. After the 5-day disability period the patient is usually returned to work.

No untoward results have been seen in the 5 months since this work was begun. In general no patients with fractures of any of the other toes have needed treatment beyond a period of 20 days. These patients are rarely given sick leave. Usually, following first-aid measures, the patient is returned to work and healing occurs within the above mentioned time limit.

Of the metatarsals, fracture of the first occurs most often. Extensive angulation has not been often encountered. Soft tissue injuries are treated aseptically, a cast with walking-iron attachment is applied, and the patient is returned home. Weight bearing is not permitted for 48 hours. In this period the initial pain and swelling subsides, after which the patient is returned to light duty. During this period he is frequently seen at the dispensary (with little time lost) and in 4 or 5 weeks is dismissed as cured. No residual disabilities secondary to the injury have developed.

Extreme cases of compound multiple fractures of the metatarsals are rarely seen. These patients are hospitalized. Fracture of the base of the fifth metatarsal bone is found in many cases which have

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been misdiagnosed as ankle sprains. The etiologic factor is marked inversion of the foot, resulting in an avulsion of the base of the fifth metatarsal bone where the peroneus muscle tendons are attached. This type of fracture may be treated by application of a cast with a walking iron, or when the displacement is not very great, by simple adhesive immobilization.

Infrequently observed are fractures of the bones of the ankle joint, which most commonly occur with extensive injuries involving multiple fractures with or without dislocations.

A very common type of injury has been a Pott's fracture, involving the distal end of the fibula. When uncomplicated by other fractures, this is reduced and immobilized in a cast with a walking iron, and within 48 hours the patient is returned to duty.

Simple, uncomplicated fractures involving the lower end of the tibia were also treated by cast and walking iron and early return to duty, with excellent results. Several rather extensive malleolar multiple fractures with dislocation of the astragalus were reduced, held in position by casts, and the patients kept ambulatory. Other fractures involving the shaft of the tibia and extending above its lower third are, however, hospitalized.

It is our opinion that the shortened period required for healing in the ambulatory patients was due to the early, active resumption of motion. It is believed that the slight rubbing of the fractured bone ends stimulated rapid callus formation.

In the upper extremities fractures of the phalanges of the thumb were *least* common, those of the index, middle, ring, and small fingers leading in order of frequency. The type of soft tissue and bone injury is the same as that encountered in the toes. Treatment is similar to that of the toes with the exception that a padded tongue-depressor posterior splint is used. The distal phalanx is most often involved, usually with a crushing injury inflicted by falling heavy objects. Treatment of such fractures, where there is soft tissue maceration and persistent hemorrhage, consists in the application of strips of adhesive anteriorly, posteriorly and laterally over the distal phalanx, extending down to the base of the proximal phalanx, with circular adhesive strips to prevent slipping. The adhesive strips serve to immobilize the entire digit in full extension. The fragments of the distal phalanx are alined and sufficient pressure is applied to obtain hemostasis without causing complete circulatory obstruction. Treatment of these patients does not involve any lost time.

Fractures of other phalanges are also satisfactorily treated by this method. Although hundreds of digital fractures were encountered, it has not been found necessary to use more extensive methods of reduction and immobilization, such as a banjo splint with traction.

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Of fractures of the bones of the wrist, most common are fractures of the navicular and lunate bones. Usually simple immobilization by means of an elastic bandage or by short circular cast is sufficient treatment, and the patient is returned to light duty.

Colles' fractures involving the distal end of the radius, with or without the complicating feature of fracture of either styloid process, are seen frequently. This fracture is reduced under local anesthesia by the Böhler method, and a circular cast, extending from below the elbow joint to close behind the proximal phalanges, is applied. This procedure retains the position of the fragments while permitting full use of the hand in gripping; thus the patient may be returned to duty almost immediately. Fractures involving either the radius or the ulna in the lower third are immobilized in a posterior molded cast in full supination, and when feasible the patient is returned to work and followed up by frequent visits to the dispensary.

Fractures involving the head of the radius have been frequently seen. When there is no joint complication and the head is not too greatly displaced, excellent results have been obtained by the commonly accepted methods of treatment. Patients with fractures of the humerus are promptly hospitalized.

Various types of dislocation of the head of the humerus are easily reduced with the aid of light anesthesia, and following a short period of immobilization, these patients are returned to work.

In all the fracture cases mentioned, various types of physiotherapy were instituted. At no time has any attempt been made to treat an extensive bone injury when such treatment was not feasible with the equipment at hand and when such attempted treatment would not have been to the best interests of the worker.

THE STINGAREES, MUCH FEARED DEMONS OF THE SEAS [1]

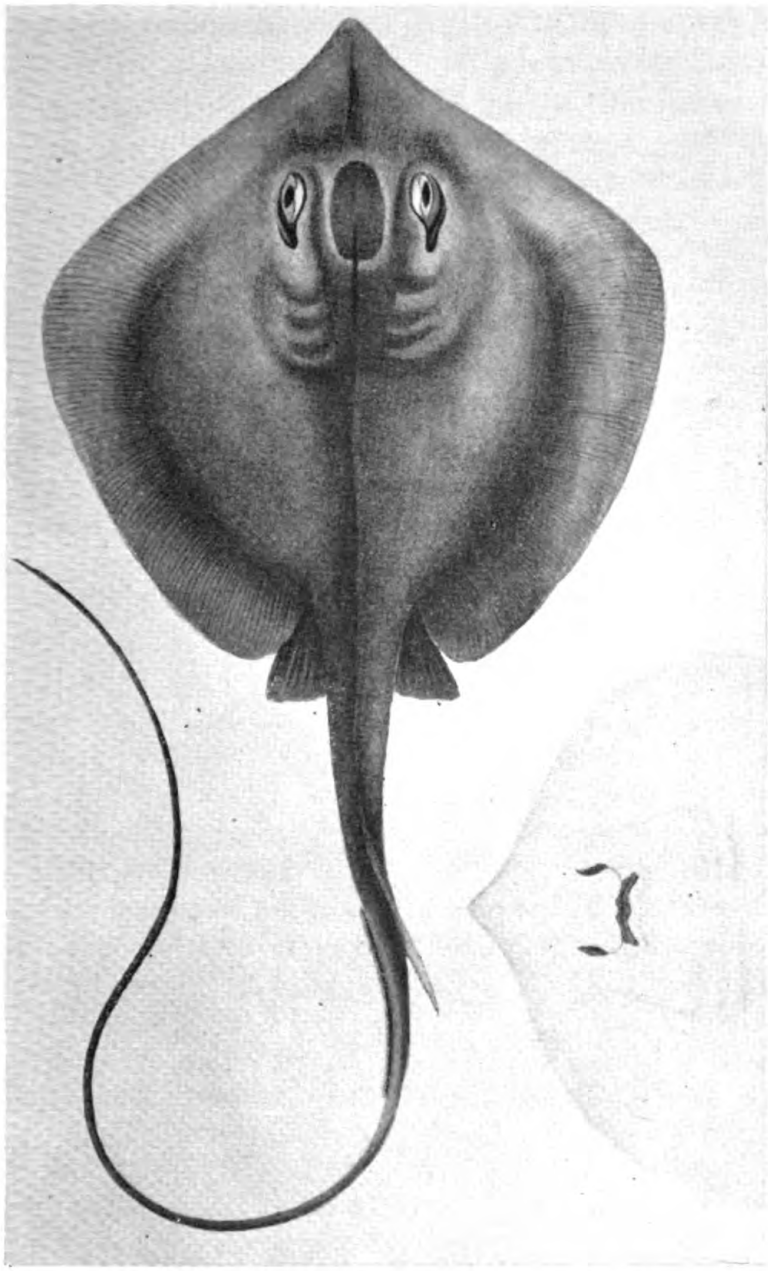
DR. LEONARD P. SCHULTZ [2]

In general, many people and some uninformed naturalists have the opinion that stingarees do not have a poisonous sting. However, those of us who have studied these fishes and have had personal experience with them, are certain that the "sting" is highly venomous. Before I cite one or more cases of persons who have been jabbed by the spine of a stingray, I shall attempt to acquaint the reader with these fishes and the nature of their sting or spines.

[1] Prepared for the Ethnogeographic Board, and published with its kind permission.
[2] Curator of Fishes, U. S. National Museum.

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The stingaree (fig. 1) is one of the rays, a fish related to the sharks and greatly resembling them in structure. In shape however the rays are flattened and disk-shaped, and have a long tail. The rays that bear a long sharp spine, usually in the middle upper part of the tail, are known as stingrays, a word corrupted to stingaree.



1. The stingray, Trygon, of the southwestern Pacific Ocean.

Several dozen different species of stingrays are known to science. These creatures occur in all warm seas, as well as in many of the tropical rivers, some freshwater stingrays in South America even occurring more than a thousand miles above the river mouth. Wherever stingrays occur—in the seas, bays, or in rivers—they are to be found

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hiding on the bottom in mud or sand. If disturbed, they swim with an undulating motion, usually close to the bottom, and stir up a cloud of mud, then come to rest on the bottom, the muddy cloud gradually settling around the ray. This "mud cloud" and the camouflaged coloration of the fish itself, serve a definite purpose in concealing it. While thus partly buried in the sand or mud bottom, the stingray is in perfect readiness to drive its sting into any unsuspecting victim who may inadvertently step on it. The weight of a person stepping on the disk-shaped part of the body anchors the stingray, giving it the needed leverage to whip its tail upward with uncanny precision and drive the already erected spine or sting into its target. The sting, on the powerful tail of even a small ray only a foot across in size, can pass through one's foot or into the bone of the leg.

Figures 2 and 3 show clearly the barbs along the sides and the groove near the base of these spines. Dr. H. M. Evans of the Lowestoft Hospital, England, who made an extensive study of the stingray, found that the poison gland of the fish occurs in this groove. The barbs tear a jagged wound and if the sting breaks off, it invariably has to be pushed on through or dissected out. J. Vellard injected the venom from the glands of South American freshwater stingrays into various animals, and in several instances death occurred in a few minutes.

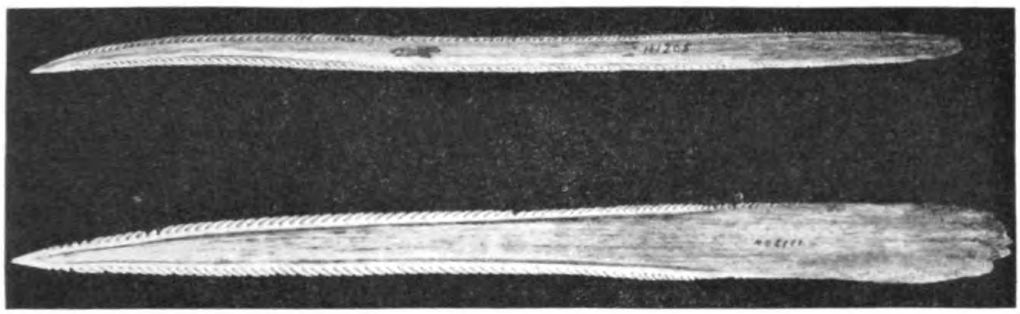
During 1942, my assistant, Rafael Navarro and I were collecting fishes for the United States National Museum in a swamp north of Sinamaica, Maracaibo Basin, Venezuela. We had walked nearly half a mile across this shallow muddy mire, pushing a small boat (cayuca) in front of us. Along the way, we noticed many stingrays measuring in size up to a foot across their disks. The water was from a few inches to a foot deep and our feet sank as far in the soft muddy bottom. We made a fair collection of the various kinds of fishes present and started back. I urged my assistant not to pick up his feet in this mud but to push them forward at the surface so that he would not step on one of these stingrays, as they lie slightly embedded in the upper layer of the mud.

Suddenly I heard Navarro cry out in agony. A stingaree had driven its spine into his ankle, but fortunately the spine did not break off. When we reached shore, I got out my first-aid kit and cleaned the wound, swabbing it out with iodine, and bandaged it. At camp that night, I found the wound was down to the bone but showed little swelling. I washed it off, put on a larger bandage saturated with 1:1000 metaphen; after a week of this treatment the lesion was completely healed.

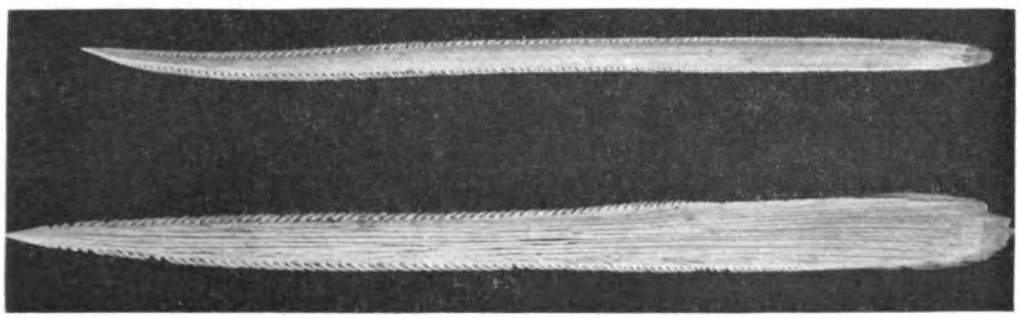
Harvey Bassler, in Science, gives a similar account of an incident occurring far up the Amazon River, when his orderly was struck in the sole of his foot. I quote: "Fabriciano, appearing to be in great pain almost immediately, cried out in terror and despair as he stag-

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gered to a nearby sandy beach to fling himself upon the sand and, holding the wounded foot with both hands, to writhe about in agony, tears trickling down his cheeks despite his resolution not to make a spectacle of himself. I had been told repeatedly that this was the most excruciatingly painful experience which could befall a man in the Amazon jungle * * *." His wound was treated and though he continued for a time in extreme, almost unendurable pain, there was no considerable swelling, nor did he experience nausea, headache, or any systemic symptoms.



2. A view of the underside of the sting. Note the groove on each side along the bases of the "teeth." This grove contains the poison gland.



3. A view of the upper or dorsal side of the same stings as shown in figure 2.

These freshwater stingrays are mere babies compared with the big ones in the warm seas of the world. One species, the giant stingaree of Australia, reaches a length of over 14 feet and a weight of at least 750 pounds. The sting in such a large fellow is usually a foot long. Evidence from fishermen around Europe indicates that the venom of stingarees in the adjacent seas is most severe, its action not greatly different from that of cobras. Bianco saw a young man become extremely pale and fall down almost senseless for a few minutes after having received only a very small puncture from the Trygon. Evans related the case of a colonist of Demerara, British Guiana, who died in violent convulsions, and of the two Indians who accompanied him, who, wounded in the feet, became seriously ill and recovered the use of their feet only after a long period of suffering. Dr. Evans continues: "Along the China coast, a 20-year-old Chinese was wounded in

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the thigh. He fainted and, on regaining consciousness, had complete numbness and paralysis of the limb affected." Gimlette said "Some Malays at Cherang Jelor, Northern Kelantan, in 1912, fastened a couple of Trygon spines to a pole and stabbed a horse. The horse became delirious and seemed likely to die."

These few accounts, and others that I know of which have happened to acquaintances of mine, definitely verify the extreme virulent nature of the venom injected by the sting of a stingaree. Besides the venom, bacteria may enter the wound and infection set in.

Since all stingarees hide, partly buried in the mud or sand of the bottom, they are always a potential danger to all who wade over such bottoms in tropical seas or in certain tropical rivers. The chief hazard is to step on one of these fishes. This is almost completely eliminated by pushing your feet along the bottom in the upper layer of mud or sand. The moment something touches the ray, it wiggles off. In addition, it would be advisable to carry a pole and probe the bottom in front of you as you walk forward. Remember the stingaree may occur in water only a few inches deep.

For treatment of the wound made by the stingray or other venomous fishes, I quote Evans: "From practical experience, I have come to the conclusion that the most useful method is to inject into the puncture a few minims of 5-percent solution of permanganate of potash. Two patients I treated in this way, having been stung by the lesser Weever in the foot, had immediate relief from pain and were able to walk away from my house in perfect comfort, and no inflammation or gangrene resulted.

"For the resulting inflammation in untreated cases, cooling lotions or hot fomentations must be applied."

No doubt some bleeding is beneficial, as it may wash out some of the venom left by the sting. Iodine has also been found useful.

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Brown, Robert B., Lieutenant Commander (MC) USNR (*Treatment of Compound Fractures Aboard a Hospital Ship*, p. 607). B. S., Allegheny College, 1929; M. D., University of Pennsylvania, 1933. Instructor in surgery, University of Pennsylvania Medical School; fellow, Harrison Department of Research Surgery. Member Philadelphia Physiological Society; Philadelphia County and Pennsylvania State Medical Societies.

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Silcox, Louis E., Lieutenant (MC) USNR (*Diphtheria in the Tropics*, p. 518). M. D., Yale University School of Medicine, 1935. Intern, Lankenau Hospital, 1935–37; assistant otolaryngologist, Lankenau Hospital, Pennsylvania Hospital, and Pennsylvania University Hospital; assistant instructor in otolaryngology, Graduate School, University of Pennsylvania; instructor, otolaryngology, University of Pennsylvania. Fellow American Medical Association; member American Academy of Ophthalmology and Otolaryngology; diplomate American Board of Otolaryngology.

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Steinberg, Charles L., Lieutenant Commander (MC) USNR (*Mumps Meningoencophalitis*, p. 567). M. D., University of Colorado School of Medicine, 1928. Intern, St. Louis City Hospital, 1928–29; resident and chief resident, Children's Hospital, Denver 1929–30; attending pediatrician, Ancker Hospital, St. Paul, Minn.; member of staff, St. Joseph's Hospital. Fellow American Medical Association; member Northwestern Pediatric Society; diplomate American Board of Pediatrics.

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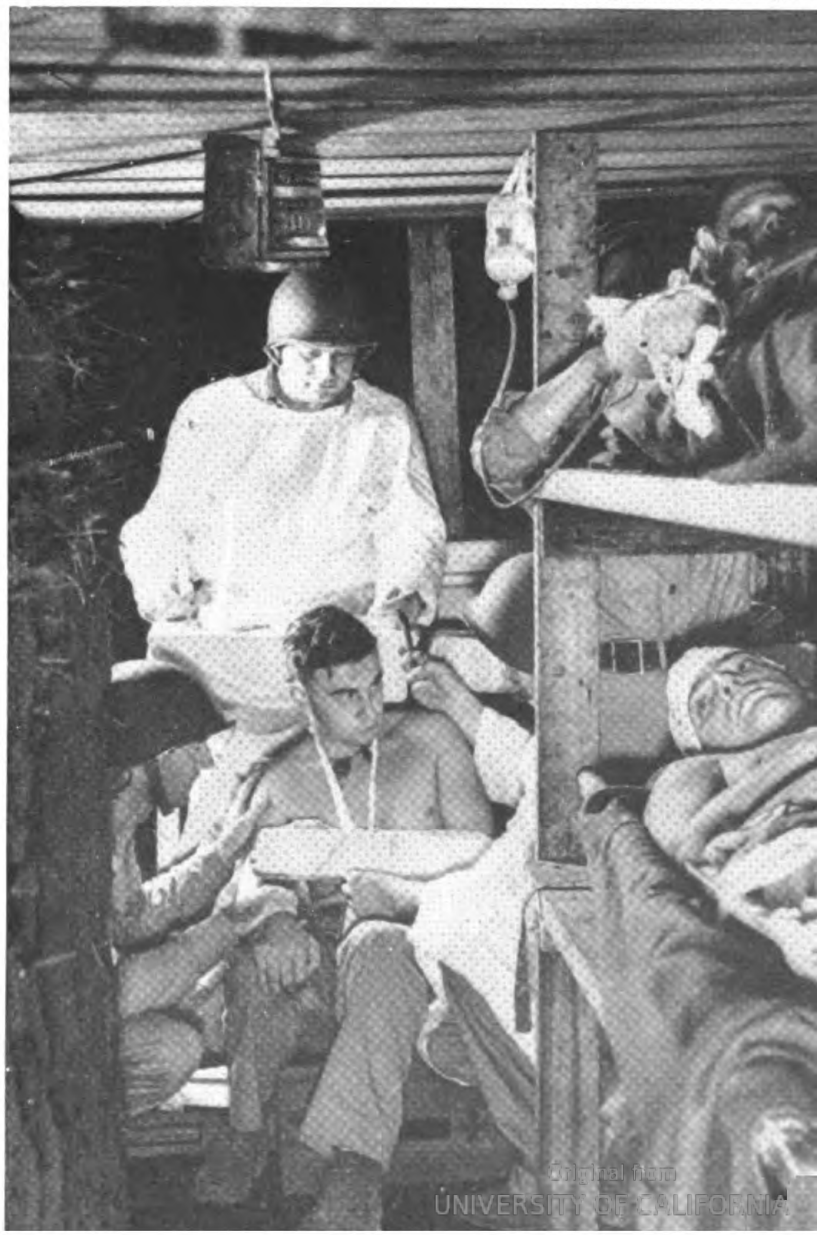
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WASHINGTON, D. C.



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COVER PHOTOGRAPH

The sickbay goes underground. In this South Pacific shelter, wounded are being cared for until safe evacuation to hospital ship or base hospital is possible.

—Official U. S. Marine Corps Photo.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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In submitting articles for publication the author should include a signed statement to the effect that "the opinions or assertions contained therein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large." (Art. 113 (2) U. S. Navy Regulations.)

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The editor regrets to have to say that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANSDELL, *Editor*,
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U. S. NAVAL MEDICAL BULLETIN

VOL. XLII APRIL 1944 No. 4

SPECIAL ARTICLES

INTERVERTEBRAL DISC PROBLEM IN THE NAVY

F. KEITH BRADFORD
Lieutenant Commander (MC) U. S. N. R.

It is becoming increasingly apparent that rupture of the intervertebral disc with root compression is an important source of disability in Navy personnel.

When disc rupture has occurred, surgery has much to offer. Only those patients, however, who after complete clinical study, are found to have frank evidence of herniated nucleus pulposus should be subjected to operation. Proper selection of cases, judicious surgery, and sagacious management will return many of these patients promptly to full duty.

The anatomic and pathologic bases for the clinical syndrome of herniated nucleus pulposus are fully discussed in the comprehensive article by Craig and Walsh (*1*) and the monograph by Bradford and Spurling (*2*).

The recent contributions of Dandy (*3*) (*4*), however, have stimulated considerable interest in the diagnosis and treatment of ruptured intervertebral disc. For those accustomed to seeing the surgical pathology in herniations, it has been difficult to picture what he terms the "concealed disk." Clinical experience has continued to be that of finding frank herniations whether the diagnosis was based upon clinical findings alone or clinical findings supplemented by contrast myelography. Adequate exposure is necessary in order to discover the offending cartilaginous mass. If operation is undertaken hastily without due consideration of all clinical findings, surgical pathology is likely to be lacking. In contrast to the experience of Dandy, whose cures took several weeks or months, the patients at this hospital have, as a rule, recovered promptly.

Clinical experience has shown that multiple herniations are exceptions. It is gratifying that the clinical examination rather than special procedures has evolved as the best index of the presence or absence of herniated nucleus pulposus. The purpose here is to summarize the better known points in history and physical examination and to elaborate only upon those less generally understood.

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History.—Lifting in a bent-forward position and suddenly twisting to regain balance are the types of trauma which most frequently produce herniation of the nucleus pulposus. Rarely is there history of an injury of violence. The absence of injury does not appreciably lessen the probability of ruptured disc when other findings are characteristic. Variation in the intensity of symptoms is the rule and complete remissions may be present. Back disability usually occurs first and persists through the period of sciatic pain. However, symptoms referable to the back may be minimal at a time when sciatic pain is extreme.

The sciatic pain is rarely bilateral and added caution in diagnosis is necessary when such is the case. Although the finding of exaggeration of pain by coughing and sneezing is very helpful, its absence does not alter the conclusion if other findings are typical. The age of the patient must be kept constantly in mind because after the fifth decade there are many other conditions which can simulate the clinical picture of herniated nucleus pulposus.

When rupture of the intervertebral disc has occurred, the radicular or sciatic pain is usually of greater severity than the back pain. Patients with incomplete sciatic radiation are far less likely to have this lesion than those with radiation into the posterior leg and (or) into the foot. Spinal lesions which cause no root compression will often produce pain radiating to the buttock or posterior thigh. While it is true that patients with rupture of the intervertebral disc may have aberrant radiation of pain (i. e., into the groin or down toward the coccyx), nevertheless such aberrant radiation is not typical and the various pains must be evaluated carefully. Radiation of pain to the anterior thigh, anterior knee, upper spine, flank or abdomen is strong evidence against disc pathology. The presence of paresthesia in the skin of the leg or foot is important when it occurs. Paresthesia may be present spontaneously, after exercise, in certain positions only, or on coughing and sneezing. The frequent statement that the leg "goes to sleep easily" is usually of no significance.

Physical examination.—The physical examination must be complete, including in all instances rectal, pelvic, and careful regional examinations. Not infrequently the syndrome of low back and sciatic pain is explained on a basis of bone or spinal cord tumor, prostatic or other malignancy, spondylolisthesis, or lesions (wound, abscess, or injury) along the course of the sciatic nerve.

Objective findings in ruptured intervertebral disc can be divided into back findings and radicular findings. The findings in the back are identical to those found in various affections of the lower lumbar articulations, without posterior herniation of the nucleus pulposus. Therefore, unless accompanied by radicular symptoms and findings,

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they do not indicate rupture of the disc. Similarly, if accompanied by no back manifestations, a radicular (sciatic) syndrome would not likely be due to herniation of the nucleus pulposus.

Objective back findings.—Pain occurs on quick, unprotected movements which are cautiously avoided by the patient. Protective posture, however, enables the patient to cooperate in the various tests without severe pain and many movements are perfectly free. On the contrary the hysterical or malingering patient will appear helpless and will complain of every maneuver. However, some patients who have suffered a great deal may have a "hysterical overlay" which can be penetrated by the careful observer.

Lumbar lordosis is usually reduced and may be reversed. While "sciatic scoliosis" may occur without sciatic pain, it is especially common with the sciatic pain resulting from intervertebral disc rupture. In such instances the iliac crest is elevated almost uniformly on the side of sciatic pain and the lumbar spine is deviated to the opposite side. The upper trunk may remain bent forward and toward the opposite side, or a secondary curve may bring the trunk and shoulders erect again. Scoliosis may occur in the opposite sense and occasionally will alternate between the two sides. Forward bending is limited to 50 or 75 percent of normal. Hyperextension is variably limited and often increases sciatic pain when it is present. Lateral bending is moderately limited.

It is when the sciatic syndrome is added to this mechanical back disability that rupture of the intervertebral disc with root compression is suspected. Usually the radicular pain is more severe than the back pain. Exaggeration of root pain by cough or sneeze is much more suggestive than exaggeration of back pain alone. The patient is not infrequently aware of paresthesias in a localized area below the knee. They may take the form of tingling, burning, electric shock, or a feeling of thickness of the skin. Weakness is not usually detected by the patient unless there is a partial foot-drop. The complaint that the whole leg feels weak or numb has not been helpful in diagnosis.

Objective radicular findings.—Although it is possible for root compression by herniated nucleus pulposus to occur without sensory, motor, or reflex findings, it is unusual. Definite findings, even of slight degree, are of extreme diagnostic importance both as to the presence of a herniation and as to its location.

The sensory examination is best conducted with a pin or other sharp testing instrument. Cotton or a blunt object is unsatisfactory because of differences in skin thickness over friction points. Hot and cold will occasionally confirm findings which were only suggested by examination with a pin. Great care must be exercised by the examiner not to produce sensory changes by suggestion. Comparison must be made

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between the two lower extremities and between different areas in the affected extremity. The saddle area must be tested religiously since its involvement points either to a very large herniation or to a neoplasm. Generalized hypesthesia of one lower extremity is generally of hysterical origin and vitiates the sensory examination. Herniated nucleus pulposus damages the first sacral root at the lumbosacral disc or the fifth lumbar root at the fourth lumbar disc. Positive sensory



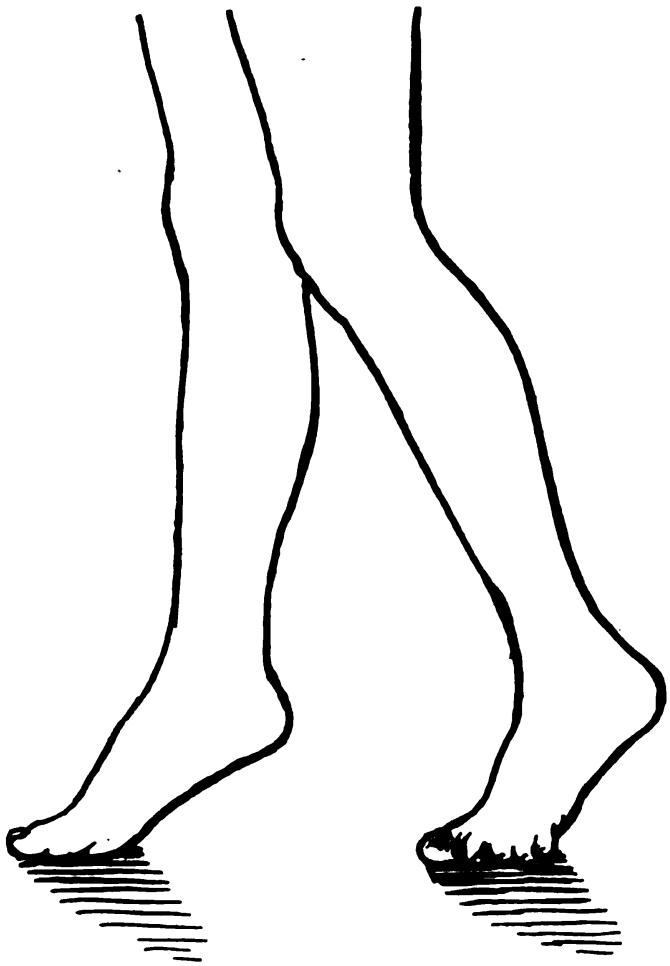
1. The black area defines the limit of hypesthesia resulting from severe or complete involvement of the fifth lumbar and first sacral roots respectively.

findings (fig. 1) consist usually of hypesthesia along the lateral aspect of the foot and (or) extending in a strip up the posterolateral calf (lumbosacral disc), or hypesthesia along the dorsum of the great toe and first metatarsal bone and (or) extending up the leg in a strip overlying the anterior tibial muscle (fourth lumbar disc). Spreading.

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tingling or burning paresthesias, when elicited in such areas by stroking with a pin, indicate a root lesion.

The *motor* examination has proved far more helpful in the diagnosis of ruptured disc than at first seemed likely. Since but one root is usually involved, only a mild paresis is likely to result. This cannot be detected by examining manually for weakness. The muscles of the leg must be tested under weight-bearing. The Achilles group is tested by having the patient walk on his toes (fig. 2). Tendency to drop the

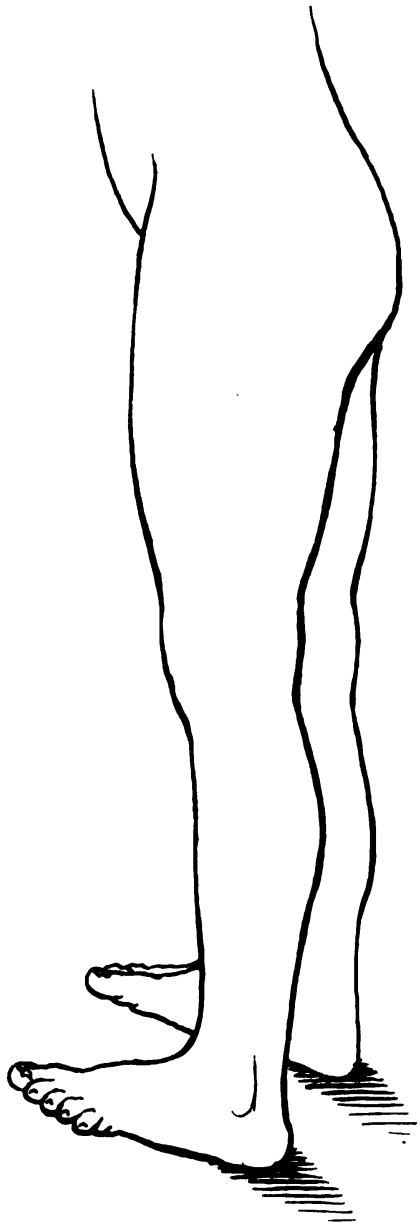


2. Strength in the gastrocnemius and soleus muscles is tested by having the patient walk briskly on his toes.

heel to the floor when stepping on the affected toe shows obvious weakness. Hopping on the toe or springing briskly to the toe when standing on one foot reveals a slighter weakness. For finer testing the patient must keep his knee straight since flexion brings the center of gravity over the ball of the foot, thus requiring less tension on the tendo achillis to rise on the toe. Anterior tibial weakness is shown as toe-slapping when attempt is made to walk on the heels (fig. 3).

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Finer testing consists of pushing the toes to the floor when the patient has his whole weight on one heel. There is no objection to the patient's holding to something with his hands to maintain balance. Weakness of the long extensors of the toes is among the commoner iso-



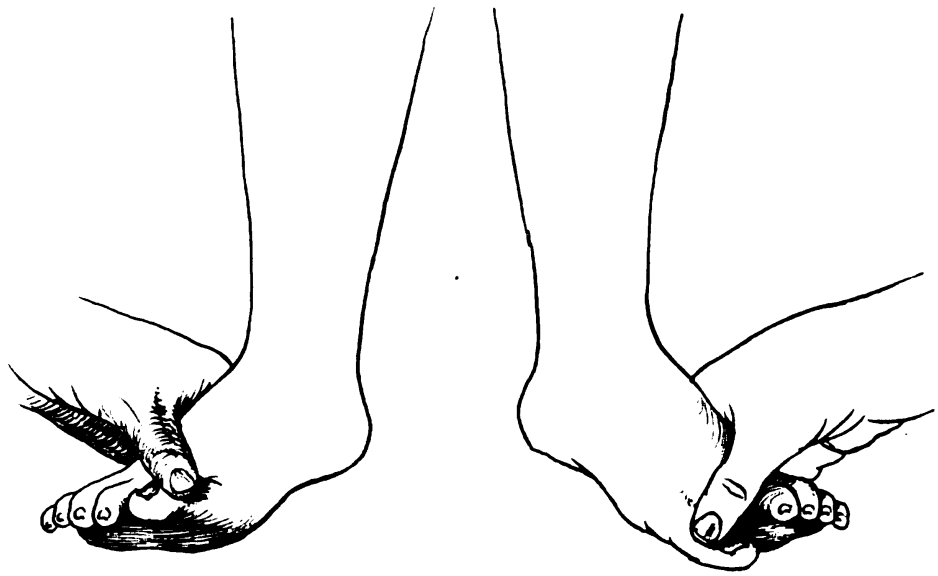
3. Strength in the anterior tibial muscle is tested by having the patient walk briskly on his heels.

lated pareses in disc lesions. It is most apparent in testing extension of the great toe. With the patient standing, the great toes are dorsiflexed as forcibly as possible. The great toes are then depressed to the floor by pressure on the distal ends of the proximal phalanges

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(fig. 4). The other muscles of the lower extremities are tested, but changes in strength are not nearly so apparent.

When tested in the manner outlined, weakness can be definitely shown in many patients with lumbar herniations. It is brought out very clearly when present, and equivocal changes are ignored. Most patients with loss of the ankle jerk will have demonstrable weakness of the Achilles group. This is generally a result of lumbosacral herniation. Of greater value is the presence of extensor hallucis or anterior tibial weakness in herniations at the fourth lumbar intervertebral disc because there is no tendon reflex at this segmental level.



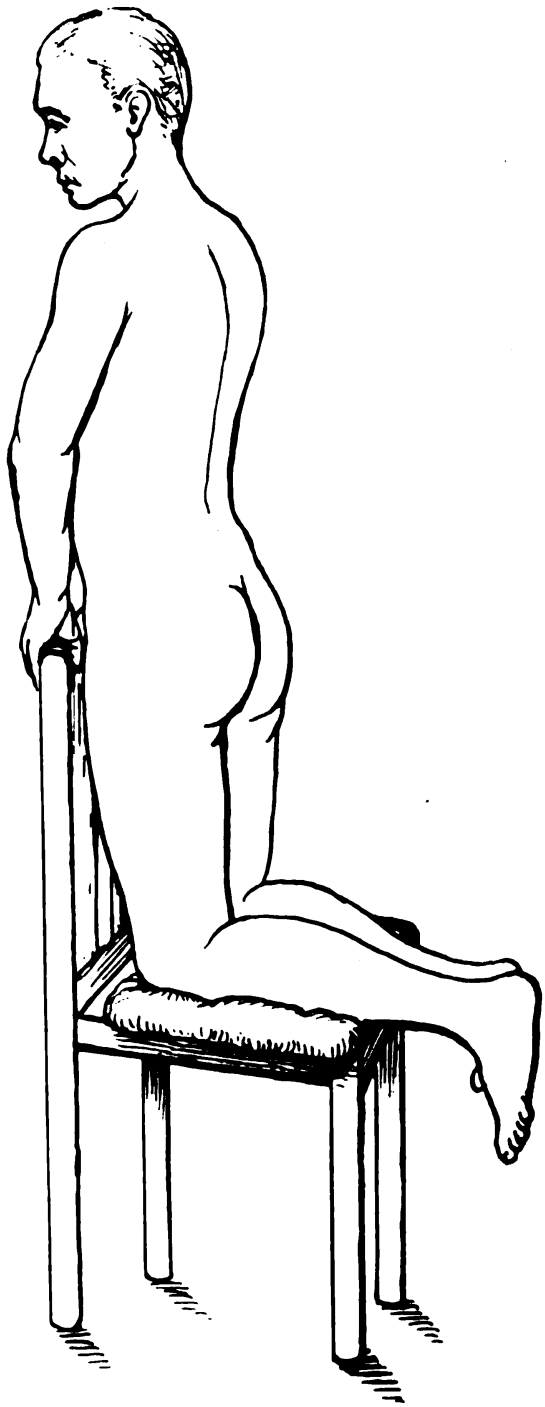
4. Weakness of the extensor hallucis longus is detected by depressing the dorsiflexed toe at the interphalangeal joint. In the left foot, involvement of the fifth lumbar nerve is indicated by weakness in dorsiflexion of the great toe.

The *ankle jerks* are of great importance and must be tested in a manner leaving no doubt about alterations. If the patient voluntarily contracts the anterior tibial muscle, it will inhibit the reflex. When any doubt exists, the ankle jerks should be elicited in several different positions. They can usually be obtained readily with the patient kneeling on a cushioned chair (fig. 5), with the patient sitting with his legs hanging free, with the patient prone and the ankles free over the end of an examining table, or with the patient supine with hip and knee flexed.

These radicular findings, sensory, motor or reflex, are of the utmost importance since they indicate actual root involvement. Kellgren (*5*) has shown experimentally that a sciatic pattern of radiation may result from a deep ligamentous injury without actual root involvement. However when this is the case there are no radicular findings. In

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addition, he found that pain was likely to be maximal near the site of the deep ligamentous involvement. With true root involvement pain may be greatest anywhere in the course or distribution of the affected root.



5. The optimal position for eliciting the Achilles reflex is shown. It should be elicited both without and with slight pressure on the ball of the foot.

The differential diagnosis between fourth lumbar and lumbosacral herniations has been summarized in table 1.

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TABLE 1.—*Differential diagnosis between fourth lumbar and lumbosacral herniations*

Fourth lumbar disc (L–5 root)	*Lumbosacral disc (S–1 root)*
Paresthesias of great toe and anterolateral leg.	Paresthesias of lateral foot and posterolateral leg.
Slight paresis of extensor of great toe or of tibialis anterior.	Slight paresis of Achilles muscle group.
Hypesthesia of great toe and anterolateral leg (or spreading paresthesias on stimulation).	Hypesthesia of lateral foot and posterolateral leg (or spreading paresthesias on stimulation).
Rarely diminished ankle jerk.	Usually diminished or absent ankle jerk.
Paravertebral pressure or percussion at fourth lumbar interspace produces radiating phenomena.	Paravertebral pressure or percussion at lumbosacral interspace produces radiating phenomena.

CONTRAST MYELOGRAPHY

Since many cases of ruptured intervertebral disc can be diagnosed on clinical grounds alone, contrast myelography is used much less frequently than formerly. However, there remains a group of patients with less conclusive findings who will require contrast myelography to verify or disprove a disc lesion. Since the ideal contrast medium is still lacking, it is necessary to consider the relative merits established for those available. Pantopaque (ethyl iodophenylundecylate) is comparable to lipiodol (iodized poppy-seed oil) except that it has a much lower viscosity. This important property makes it easy to aspirate and obviates the necessity of leaving the roentgenologic evidence of its use. Air myelography, in excellent hands, has proved valuable, but all too frequently must be followed by iodized oil myelography, or operation must be undertaken without the actual confirmation which was sought.

Thorotrast cannot be considered in the same paragraph with these other relatively innocuous media. Although it is roentgenologically adequate, the inconvenience and danger to the patient are so great that the continued use of thorotrast can hardly be rationalized.

A table has been prepared to present the advantages and disadvantages of these contrast media (table 2).

TABLE 2.—*Comparison of intraspinal contrast media*

	Advantages	Disadvantages
Pantopaque	Excellent contrast. Demonstrates small irregularities. Easy to aspirate. Minimal after-effects. Minimal evidence after aspiration. Can examine entire spinal canal.	
Lipiodol	Excellent contrast. Demonstrates small irregularities. Moderate after-effects. Can examine entire spinal canal.	Difficult to aspirate. Aspiration usually less complete or multiple aspirations are necessary.
Air	No aspiration necessary. Moderate after-effects. No evidence of medium.	Poor contrast. Does not demonstrate small irregularities. Cannot examine entire spinal canal.
Thorotrast	Excellent contrast. Demonstrates small irregularities.	Complicated procedure for drainage. Severe after-effects. Residue after drainage. Cannot examine entire spinal canal.

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It is thought worth while to present the clinical course of a patient who received thorotrast intraspinally.

A Marine sergeant, 23 years of age, was suspected of having a ruptured intervertebral disc although there were no positive neurologic findings. On the day following thorotrast myelography the patient developed a typical meningitic syndrome and was transferred to the contagious ward. At that time the spinal fluid cell count was 12,000 per cu. mm., predominantly polymorphonuclear in type. Refractile bodies (thought to be thorotrast particles) were seen in the cells, but no organisms were found. The patient remained irrational 3 days and the meningeal reaction persisted for 1 week. Recovery was complete, but a layer of radiopaque material was demonstrable in the anterior part of the lumbar spinal canal 7 months later.

Pantopaque.—Since there have been reports of many technical difficulties in using pantopaque it seems desirable to give a detailed account of its use. At first considerable difficulty was encountered in injecting it properly into the subarachnoid space. In several successive failures the pantopaque was injected into the posterior subdural space as revealed by lateral roentgenograms. In these instances it would often flow from the first lumbar vertebra to the lumbosacral disc, but the flow was not free. In addition it failed to outline the axillary pouches and did not outline a normal terminal sac when the patient was in the erect position.

Several things were varied in an effort to secure uniformly successful subarachnoid injection. Subdural injection was observed much more frequently with pantopaque than in earlier experience with lipiodol. The only important difference between the two iodized oils is the markedly lower viscosity of pantopaque. This makes possible a much more rapid intraspinal injection. It appeared that the rapid injection of pantopaque was the cause of subdural penetration. Recently with slow (1 to 2 minutes) injection of pantopaque, subarachnoid injection has almost uniformly resulted in the hands of several different operators.

The pantopaque is injected at the fourth lumbar or lumbosacral interspace, the choice being opposite the nonsuspected intervertebral disc. The patient lies prone on the fluoroscopic table with his feet resting on a footboard. The feet are lowered so that the long axis of the patient rests at a 45° angle with the horizontal. The puncture is made as precisely as possible with every effort to enter the midline of the sac. The subarachnoid space is barely entered at first and then the needle is inserted about 3 mm. deeper. The pantopaque is not injected unless a perfectly free flow of cerebrospinal fluid is obtained. After slowly injecting 3 cc. of pantopaque, the stylet is replaced, the needle is covered, and fluoroscopy is performed as after lipiodol injection. At present a No. 18 spinal needle is used. The needle should have a short bevel and must be sharp. The bevel is directed downward.

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It is of great importance that spot-films be made because the added detail will often give valuable information not obtained by the fluoroscopic examination. The value of films as a permanent record of the examination is also great. Spot-films are made routinely with the pantopaque balanced opposite each of the lower two intervertebral discs, and with the sacral sac completely filled by having the patient stand upright. The pantopaque is always followed into the lower or middle thoracic region to assure its free movement in the subarachnoid space. This can usually be accomplished by the slight head downward tilt possible on the average fluoroscopic table, supplemented by slight (15 cm.) elevation of the patient's hips. If there is any question about the upward flow of pantopaque or if there is any reason to suspect a higher lesion, the patient is shifted end-for-end, remaining in the prone position.

After fluoroscopy is completed and the spot-films are checked for satisfactory exposure, the pantopaque may be aspirated. The table is brought to an angle such that the point of the spinal needle is in the center of the column. A small syringe is attached to the spinal needle and the gentlest traction is applied to the plunger. With proper technic it is often possible to remove 90 percent of the pantopaque at the first attempt. When spinal fluid begins to flow the patient can be rotated a little, first one way and then the other, in case the needle is not exactly in the midline. It will often be necessary to rotate the needle or alter its depth slightly. It is important to remember that aspiration will either be possible with a very minimal force or will be completely impossible. Forceful aspiration tends to cause pain, initiate bleeding, and displace the needle. After the first aspiration the patient is again fluoroscoped and his position altered to bring the needle into the center of the residual oil.

The reduction in the lumbar lordosis which is common in herniation of the nucleus pulposus may cause less pooling of the pantopaque with greater difficulty in removing it. The pool is deepest where the curve is greatest (lumbosacral) and its depth diminishes as the curve lessens in the upper lumbar region.

Operation may follow pantopaque myelography on the day succeeding or at a later date. No symptoms other than those occasionally complicating spinal puncture have been observed and it actually seems that complaints are fewer.

OPERATIVE TECHNIC

The partial hemilaminectomy has now become routine. Various special retractors and instruments simplify the operation. No effort is made to remove herniated nucleus pulposus by excising ligamentum flavum alone because the added exposure obtained by removing the

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laminal margins above and below permits better interpretation of pathology and more satisfactory treatment. There is no disadvantage to local adequate exposure, even if spinal fusion should later be necessary. It is of paramount importance that the surgeon interpret correctly the surgical pathology present. After exploring the lumbosacral or fourth lumbar intervertebral disc on one side, the surgeon must be quite certain that he has accounted for the patient's symptoms.

A number of patients have been operated on in the sitting position as recommended by Shelden (*6*). With the lumbar spine in flexion and bearing weight the herniated cartilage stands out much more prominently than when the patient is prone. A detailed description of the advantages of this position is under preparation.

RESULTS

It is felt that the satisfactory results obtained have been adequate repayment for the care taken in accurate diagnosis. Postoperative care has permitted moderate activity even a few hours after operation. A patient will often sit on the edge of the bed or stand in order to void on the evening of the day of operation. During the next 2 days the patient is allowed to be up as tolerated. There have been complications arising from discussion between patients convalescing from the same operation. However the result is usually one of increased morale. And when the timid patient who has remained in bed 3 days gets up, he finds that once erect he is able to perform as well as others. There is believed to be no adequate reason for preventing activity after the first 24 hours. During the immediate postoperative period the chief danger is hemorrhage, but it is felt that this is unlikely and is less than the danger of cystitis from catheterization. Wound disruption has never occurred and need not be considered if wound closure and dressing are adequate.

Since it is known that the tear in the annulus fibrosus would require months for healing, it is not felt that 2 to 3 weeks of bed rest would aid materially in repair.

The return to duty has depended chiefly on how the patient feels, and this method seems vindicated by the fact that there have been no known readmissions of patients discharged to duty. Undoubtedly there will be recurrent symptoms. Patients who are well adjusted in their duties are certainly much more likely to recover rapidly and are less likely to report with minimal recurrent symptoms.

All patients are instructed to lift by using their knees. They are told to avoid any heavy lifting, particularly while in a bent-forward position. Athletic events are avoided for 6 to 12 months. Although some patients have returned to full physical activity without difficulty, caution seems advisable.

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CONCLUSIONS

1. Accurate clinical diagnosis of ruptured intervertebral disc is essential, whether or not myelography is used.

2. The Achilles reflex, although usually diminished or absent in lumbosacral lesions, is not commonly altered in fourth lumbar herniations which have an almost equal incidence.

3. Pantopaque, because of its easy aspiration, is the contrast medium of choice.

4. Partial hemilaminectomy with adequate exposure is the preferable operative technic. Although spinal fusion has a well established place in disc extrusions, it should be used cautiously in naval personnel because of the increased morbidity.

5. No special procedures such as myelography should be performed except under the auspices of a trained neurologic surgeon who has all the necessary facilities for diagnosis and operation.

6. Gratifying results will follow proper selection of patients and careful surgery.

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HEMILAMINECTOMY TECHNIC FOR HERNIATED LUMBAR DISCS

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The first herniated discs were removed by the usual laminectomy technic for spinal cord tumors and for other conditions requiring spinal canal exploration. In 1939 Love (*1*) advocated a limited exploration by removing the periosteum and muscle attachments from one side only of the spinous processes. None or only a small part of the adjacent edges of the laminae was included.

On exploring and removing discs in 53 cases, using a unilateral approach, difficulty has consistently been encountered in obtaining and securing sufficient retraction to give adequate exposure. The most resistance was offered not by the muscle, but rather by the tendinous, tight midline attachment of the lumbodorsal fascia and its thickened portion at its attachment to the supraspinal ligament. A part of the latter is nearly always included in the portion to be retracted, since the usual incision is made in the midline down to the tips of the spinous processes. A subperiosteal elevation is continued from the tip downward and laterally over the lamina (fig. 1).

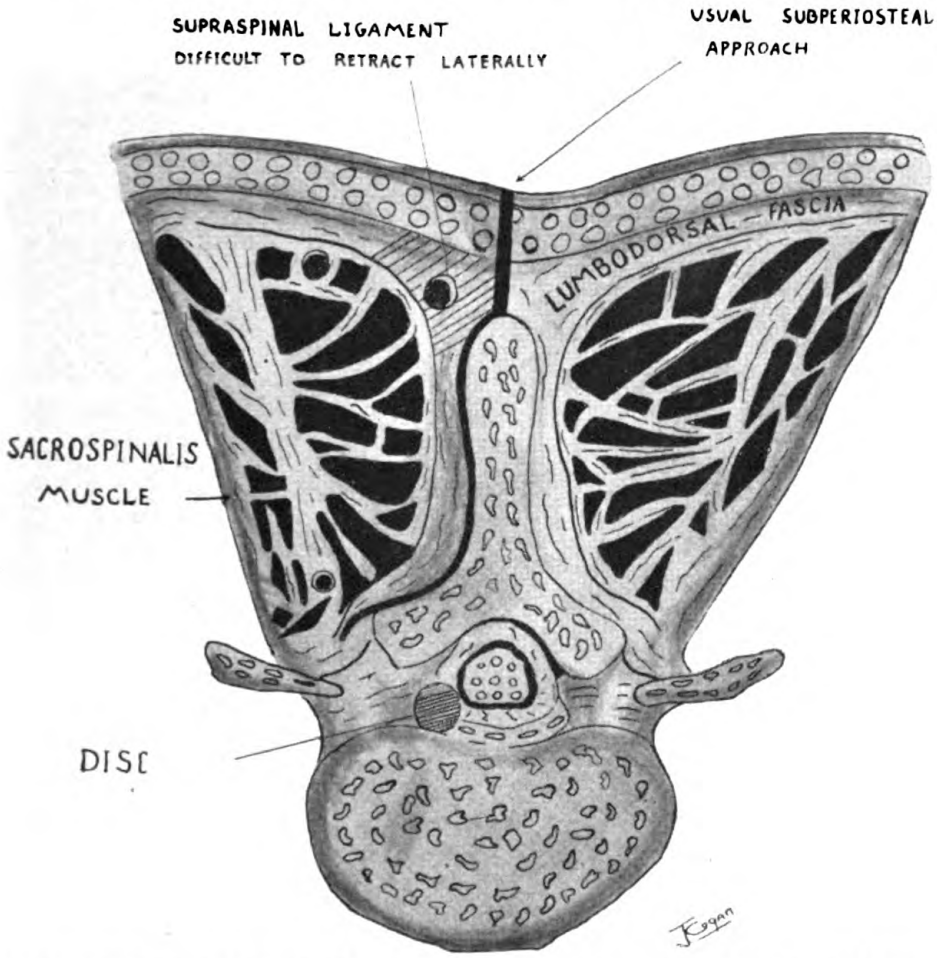
With this approach considerable continuous retraction is required in order fully to expose the laminae. The fascia and its thickened midline portion remain tight, and a retractor of considerable strength and thickness is needed if adequate exposure is to be obtained. The available retractors have serious disadvantages in this regard.

While witnessing an operation for inguinal hernia, the ease with which the fascia of the external oblique muscle was separated and retracted downward, provoked the thought that the same principle might be used in unilateral explorations for herniated discs. Therefore a change in the technic of hemilaminectomy was tried, resulting in several marked and unexpected advantages, and a preliminary report of the technic was made (*2*). Recent articles (*3*) (*4*) discussing various types of approach and methods of retraction, suggest the importance of emphasizing an improvement in technic.

Surgical anatomy.—The lumbodorsal fascia is attached in the lumbar region to the spinous processes and to the thick supraspinal ligament. This ligament is a strong, fibrous cord connecting the apices of the processes, and at the points of attachment cartilage is found

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within the ligament. Between the processes are broad, thick, quadrilateral membranes extending from the process roots and ligamentum flavum below to the supraspinal ligament above. Only two muscles need be considered; the sacrospinalis which arises in part by tendons from the tips of the spinous processes and its supraspinal ligament, and the multifidus, consisting of a number of fleshy and tendinous fasciculi,



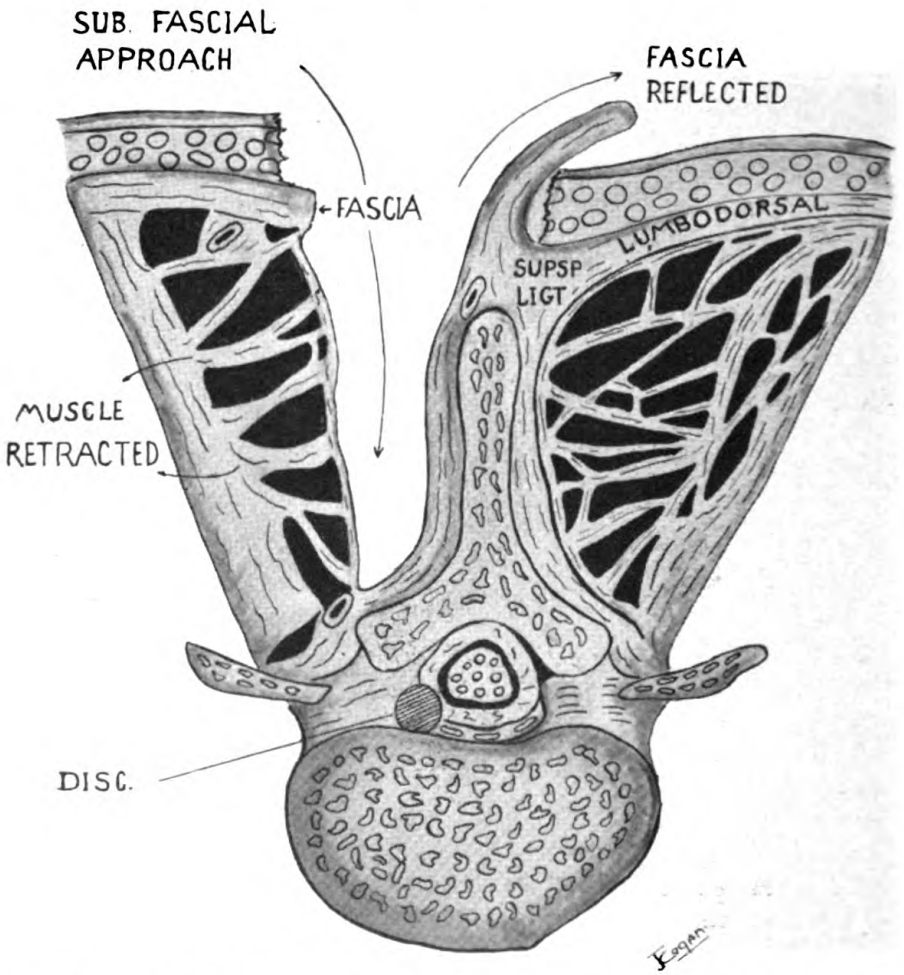
1. Showing midline incision through supraspinal ligament, subperiosteal resection, and the difficulty encountered in retracting ligament and fascia.

arising laterally from the mamillary processes and inserting into the body or root of the spinous process from one to four vertebrae higher.

A large part, therefore, of the surfaces of the spinous processes, interspinal ligaments and laminae are smooth and do not have broad-base muscle attachments; rather the muscles insert or arise by thin tendons, requiring merely severing of these tendons in order to retract the muscles laterally and expose the laminae. Exposure of the tips and subperiosteal elevation is therefore not necessary for muscle retraction. On severing the tendons and with careful retraction, the posterior and medial surfaces of the muscles remain smooth, glistening, and surprisingly free of injury and bleeding.

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Technic (*fig. 2*).—A midline incision is made through the skin and subcutaneous tissue. The underlying lumbodorsal fascia is then incised 2 to 3 cm. lateral to and parallel with the midline, and the medial flap between the incision and its attachment to the midline is elevated, bluntly dissected from the subjacent muscle, and reflected medially. With a narrow retractor or blunt periosteal elevator, the body of the sacrospinalis muscle can then be gently retracted laterally from the lateral surfaces of the spinous processes.



2. Showing subfascial approach, reflecting fascia medially without disturbing supraspinal ligament. Muscle is easily retracted.

The tendinous origins of this muscle and the smaller insertions of the multifidus muscles are each identified and severed near the periosteum. The mass of muscle can then be covered with a thin laparotomy sponge, retracted and held in place by medium-weight spring retractors. The edges of the laminae are then cleaned of periosteum, loose fat and areolar tissue, but no attempt is made to clean the spinous processes of periosteum or of the short interspinalis muscles. Further exploration is done as indicated.

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For closure no sutures are needed in the muscle; interrupted fine catgut, silk, or cotton sutures are used to close the vertical incision made in the lumbodorsal fascia; the subcutaneous tissue and skin are closed as desired.

Advantages.—The advantages of this procedure are apparent. The approach is rapid, and the midline attachment of the lumbodorsal fascia and the supraspinal ligament need not be retracted. There is markedly less bleeding due to less damage to the muscles and periosteum. Ease of retraction of the muscle through a laterally placed fascial incision, without retracting the midline ligamentous structures, permits a wider exposure with less forceful retraction, and affords a line of vision at an angle to the spinous process. Closure is effected with a few light sutures in the fascia. In the last 12 cases in which this approach was used the impression was gained that there is less postoperative lumbar stiffness and distress.

Should the opposite half of the ligamentum flavum need removal, it can be done through the same incision by resecting the lower one-third or one-half of the interspinal ligament, without disturbing the supraspinal ligament. Should bilateral exploration be indicated, the same procedure can be carried out on the opposite side in like manner, using the same skin incision, without disturbing midline structures.

SUMMARY

Surgical-anatomic consideration of the lumbar area suggests an approach for removal of herniated discs which follows more anatomic lines of cleavage. The procedure consists of a laterally placed incision through a thin portion of the lumbodorsal fascia, following the muscle-fascial plane, severing tendons, and leaving the thick, tendinous midline structures and periosteum intact. By retracting the muscle through the fascia rather than together with the incised midline ligament, many advantages are gained, particularly those of improved exposure, less tissue damage and less postoperative distress.

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FRACTURES OF TRANSVERSE PROCESSES OF LUMBAR VERTEBRAE

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Fracture of the transverse process of the lumbar spine while not a serious injury has by most methods of treatment given prolonged disability. The period of disability among combat troops is an important consideration. If of several weeks' duration, the patient must be evacuated from the combat area. In an area where air or sea transportation is the only mode of travel, space on evacuating planes or ships is at a premium. Injuries therefore that do not endanger the physical welfare of an individual should be cared for in a manner which will not necessitate evacuation.

Ferguson in 1942, following the observations made by Leriche on the response of acute fractures to local injection of novocain, advocated the use of novocain in fractures of the transverse processes of the lumbar spine.

Nineteen subjects were so treated aboard a hospital ship. Those without complicating injuries and free from pain were kept ambulatory, and had a short period of convalescence. The local injection of novocain was therefore a more satisfactory method of treatment for military personnel than the more generally recommended procedures that had been previously employed. Recovery took place without regard to union or displacement and it was never necessary to remove surgically a fractured transverse process.

Etiology.—Fractures of the transverse processes of the lumbar vertebrae are attributed to two causes: (1) A direct trauma such as a heavy blow on the lumbar area; (2) the sudden or vigorous contraction of attached muscles in endeavoring to resist an overpowering force.

A glance at table 1 reveals that nearly all subjects presented a history of direct trauma. The 3 possible examples of resistant muscle action are cases 6 and 10, where injury resulted from an explosion below decks, and case 12, an aviator injured in a parachute jump. The muscles most responsible are believed to be the quadratus lumborum and iliopsoas. It will be recalled that the quadratus lumborum arises from the crest of the ilium and is inserted into all 5

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lumbar transverse process and the twelfth rib. It acts as a lateral flexor of the vertebral column. The iliopsoas arises from the transverse processes of all the lumbar vertebrae and inserts into the lesser trochanter of the femur. This muscle flexes the trunk on the lower limbs and also can produce lateral flexion of the vertebral column. The pattern of muscle attachment, therefore, prevents any significant structural change as a result of the fracture. The local contusion and tear of muscles and fascial aponeurosis with resultant hemorrhage is in our opinion the lesion to be considered.

TABLE 1.—*Cause of trauma*

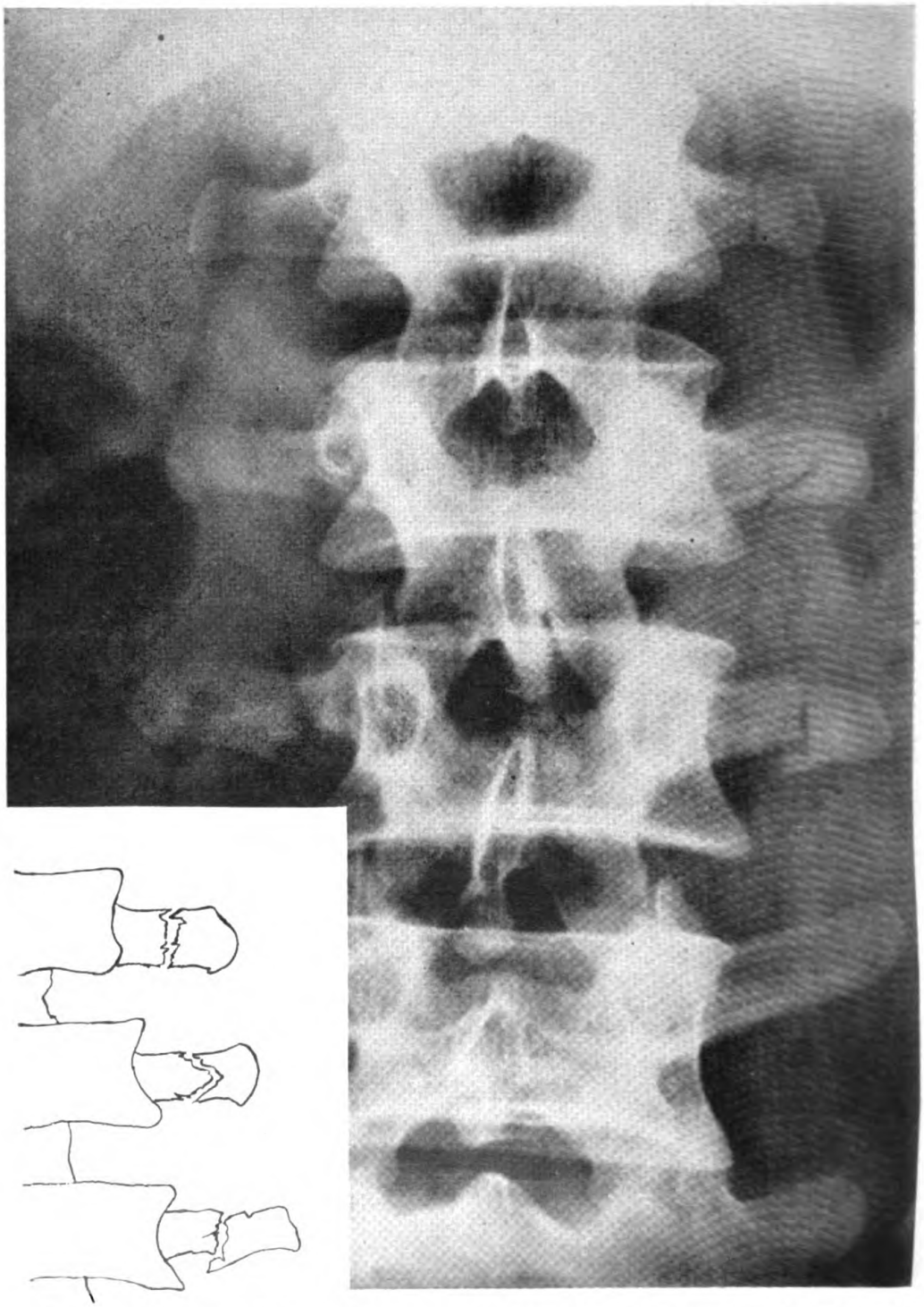
Case No.	Nature of force causing injury	Case No.	Nature of force causing injury
1	Shrapnel wound.	10	Explosion below deck.
2	Fall from horse landing on back.	11	Run over by truck.
3	Blow on back.	12	Landed on back when parachute jumping.
4	Back struck by shipmate jumping from landing boat.	13	Fell on back in Higgins boat.
5	Trampled by a stampeded herd of cattle.	14	Fell on back in whale boat.
6	Explosion below deck.	15	Fell from horse landing on back.
7	Back struck by falling tree.	16	Back struck by knee of base-runner while playing ball.
8	Back struck by bomb dropped from a moored PBY.	17	Fell on back in Higgins boat.
9	Fell on back.	18	Fell down hatch landing on back.
		19	Forced against stanchion.

Location of fracture and complicating injuries.—It is evident that the processes most frequently broken are those of L–2–3–4 (fig. 1). These processes are more exposed to direct trauma, because the processes of L–1 are protected by the lower ribs and those of L–5 by the wings of the ilium. Bilateral fracture of the transverse process occurred in only one subject, a patient who was run over by a truck. The injury does not appear to show a preference for one side more than the other, as 18 fractures occurred on the right; 19 on the left.

TABLE 2.—*Location of fracture and complicating injuries*

Case No.	Location of fracture	Complicating injury
1	Lt. L–3–4	Gunshot wound.
2	Rt. L–3–4	Fracture left ilium.
3	Rt. L–3–4	None.
4	Lt. L–2–3	Head injury.
5	Lt. L–1–2	Perforated right eardrum with secondary otitis media.
6	Rt. L–4	Fracture nasal bones; os calcis; bilat. 7–8–9–10 ribs; subdiaphragmatic abscess, rt.
7	Rt. L–3–4	Hematoma rt. chest.
8	Lt. L–5	None.
9	Rt. L–4	Do.
10	Lt. L–4	Contusion of kidney.
11	Lt. L–1–5 rt. L–2	Fractures of L–5, pelvis, spinous process of L–4, and 12th rib left.
12	Lt. L–1–2–3	None.
13	Rt. L–2–3	Do.
14	Rt. L–2–3–4	Laceration of perineum.
15	Lt. L–2–3–4	None.
16	Rt. L–3	Do.
17	Rt. L–3	Do.
18	Rt. L–2–3–4	Do.
19	Lt. L–3	Do.

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1. Case 18. Fracture of right tranverse processes of L–2–3–4, caused by fall through hatch. Returned to duty on 10th day.

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Diagnosis.—There were several diagnostic signs brought out in the examination of these patients which are worth noting. These features were representative of the group rather than any particular case.

1. List of the trunk to the affected side.
2. Restriction of lateral bending of the spine to the side opposite injury.
3. Flexion of the thigh of the affected side against resistance is painful due to the pull of the iliopsoas. In two of these cases, however, the same test performed on the opposite leg was the more painful.
4. Discomfort aggravated by standing on the leg of the unaffected side.
5. In all of the cases there was local pressure tenderness and associated muscle spasm in the region of the injured transverse process.

Roentgen features.—The diagnosis may be suspected but is confirmed by x-ray examination. Most radiologists call attention to the following distinctions to be made in the interpretation of the films.

1. Each transverse process has an epiphysis which does not unite until after the 20th year.
2. These processes may be asymmetrical and point in different directions.
3. The first lumbar vertebra may present an anomalous rib which can resemble a fracture.
4. The shadow of the psoas muscle may cause a line across a transverse process which may resemble a fracture.
5. Intestinal gas patterns may cause a line to be seen crossing the transverse process which simulates a fracture.

As a general rule the line of fracture is irregular, sharply defined, and there is more or less separation of the distal fragment.

Treatment.—Many forms of treatment are discussed in the literature. It is interesting to review some of the more common instances.

Key and Conwell suggest bed rest for 2 weeks with adhesive strapping or plaster jacket depending upon the severity of the pain. The plaster jacket is continued for 2 to 5 weeks and following its removal a lumbar belt or corset is worn for 8 to 10 weeks before resumption of normal occupation.

Scudder recommends adhesive strapping with bed rest for 1 to 2 weeks followed by the application of a low back belt and commencement of mobilizing exercises. He believes repair should be complete in 6 to 8 weeks.

Böhler recommends rest in bed for 1 to 3 weeks with use of hot air, wet compresses, and massage. He observes that the majority recover after 6 to 12 weeks without lasting complaints, although bony union often does not occur.

Watson-Jones feels that these injuries are usually regarded much too lightly, that the policy of instituting early exercise is wrong, and

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that they should be deferred until repair is sound. He advocates a plaster jacket for 6 to 8 weeks and recumbency for the first 2 or 3 days only. The jacket is discarded after 8 weeks and mobilizing exercises begun. The resumption of work is possible within 3 to 6 months.

The Military Surgical Manual on orthopedic subjects prepared by the Sub-Committee on Orthopedic Surgery of the National Research Council gives the most surprising opinion with regard to these fractures. It is stated that transverse process fractures should be thoroughly immobilized until x-ray evidence of callus is present, because nonunion in these cases results in a painful back. For this reason they advocate the application of a plaster jacket and confinement to bed until there is x-ray evidence of union which occurs in 4 to 6 weeks. In cases of nonunion of transverse process fractures with painful disability the process should be surgically removed.

TABLE 3.—*Tabulation of several forms of treatment with prognosis*

Author	Confinement to bed	Immobilization	Exercises	Normal occupation
Key and Conwell	2 weeks	Cast 2–5 weeks Back belt 8–10 weeks		8–10 weeks.
Scudder	1–2 weeks	Back belt 2–8 weeks	5 weeks 2d week	6–8 weeks. 6–8 weeks.
Böhler	1–3 weeks	None	3d week	6–12 weeks.
Watson-Jones	3 days	Cast 6–8 weeks	8th week	3–6 months.
Military Manual	4–6 weeks	Cast 4–6 weeks	6th week	

X-ray films of lumbar spines, with ununited fractures of the transverse processes from previous accidents that gave no symptoms, have been observed. It is believed that union is not necessary for a painless back, and nothing is to be gained by removal of an ununited fractured transverse process.

The policy aboard this hospital ship is to inject the region of the fractured transverse process with 10 cc. of 1-percent procaine. This injection is repeated on the 2d, 5th, and 8th day if pain and muscle spasm persist. The needle is introduced directly down to the site of the fracture as determined from the x-ray film by measuring the distance from the tip of the transverse process. After 2 cc. is injected, the needle is partially withdrawn and reintroduced, injecting above, below, and lateral to the tip of the transverse process. In no case has it been possible, by aspiration, to demonstrate the presence of a hematoma at the fracture site.

Immediately following injection exercises are instituted. In prone position, active hyperextension of the spine is done by the patient lifting his head and shoulders off the table. Then in a sitting position he rotates his shoulders as far as possible to the right and to the left. Next he performs lateral bending of the trunk to the extremes that he can tolerate. In a standing position, the subject is then asked

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to touch the deck. These exercises are carried out 15 times each and repeated twice each day. Heat and light massage are given to the back daily during the hospitalization period. On the other hand, case 19 was treated entirely as an out-patient and continued active duty on his ship.

TABLE 4.—*Uncomplicated cases completely treated aboard this ship*

Case No.	Fracture site	Inte val from injury to treatment	Number of injections	Duration of disability
3	Rt. L-3-4	7 days	2	7 days.
9	Rt. L-4	1 hour	4	8 days.
12	Lt. L-1-2-3	14 days	3	11 days.
13	Rt. L-2-3	1 hour	3	16 days.
14	Rt. L-2-3-4	2 days	4	18 days.
15	Lt. L-2-3-4	10 days	4	17 days.
16	Rt. L-3	2 days	1	2 days.
17	Rt. L-3	2 days	2	6 days.
18	Rt. L-2-3-4	1 day	2	10 days.
19	Lt. L-3	4 days	3	0 days.

Case No. 9, a member of the ship's company, was treated as an out-patient and received a procaine injection during the first hour following injury. He immediately was relieved of his symptoms and returned to duty. Two days later he had a recurrence of back pain upon lifting a boom, following which three injections of procaine at the intervals specified were necessary and he again returned to duty on the eighth day. Case No. 17 after two injections was symptom free, and in 6 days was discharged to duty. Three days later he was lifting a heavy bucket of water and suffered a recurrence of back pain. During the second period of hospitalization 5 additional procaine injections were necessary to relieve pain and muscle spasm and 22 additional days hospitalization were required before return to duty.

We believe that despite the fact that individuals with transverse process fractures may be symptom free in an average of 10 days' time, the torn muscles and fascial structures are not completely repaired. Duty requiring heavy manual labor would best be deferred for 4 weeks. If this plan is observed, some subjects may continue work without hospitalization, reporting for procaine injections until muscle spasm has subsided, as illustrated by Case No. 19.

DISCUSSION

The work of Leriche has called attention to the fact that procaine at the fracture site and neighboring ligaments brought about three effects which are more or less interdependent: (1) Elimination of the reflex arc of pain; (2) activation of early mobilization; (3) interruption of vasomotor phenomena.

Eliminating pain is an important consideration, for it relieves the patient's worry about his back and prevents the possibility of a neurotic fixation which would lead to a prolonged disability.

In considering the activation of early mobilization, the consequences of trauma to tissues should be kept in mind. Exudate and hemorrhage become organized into scar tissue about muscle, ligaments, vessels, and nerves and interfere with muscle function, normal circulation and spinal motion. The stiffness, soreness, and limited func-

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tion following a fracture are due in large part to such scar tissue. Active exercise that can be performed without pain or muscle spasm improves the vascular and lymphatic circulation, thereby eliminating the swelling and soreness, and in turn reduces the period of convalescence.

The sympathetic system is stimulated by injury. The response is peripheral vasoconstriction. Procaine injection into the injured part causes temporary removal of vasoconstrictor tonus, vasodilatation, and improvement in the circulation. This aids in absorption of hemorrhage and exudate and promotes more rapid healing.

It is difficult to say which of these three factors is the principal therapeutic one; the elimination of pain, early mobilization, or blocking normal vasomotor phenomena. They all seem to play equally important roles which are interdependent.

The sooner treatment is instituted, the sooner the return to duty. This is borne out by the fact that those patients who receive rest in bed for 7 to 14 days prior to hospitalization failed to show a shorter convalescent period following the initiation of procaine injections than those injected a few hours after injury.

It is believed early mobilization is of primary importance, in order that the patient with a fractured transverse process may not be impressed with the fact that he has an injured spine. The early elimination of pain and active motion quickly establishes the patient's confidence.

SUMMARY

1. Nineteen cases of fractures involving the transverse processes of lumbar vertebrae have been treated with local injections of procaine and early mobilizing exercises.

2. This treatment has eliminated pain in all subjects. Those without complicating injuries have been kept ambulatory and have been enabled to return to duty in an average of 10 days.

3. The transverse processes most frequently injured were those of L–2–3 and 4.

4. A single transverse process fracture occurred in but seven cases.

5. The period of disability was more prolonged in subjects with more than one transverse process injured.

6. The earlier the cases were treated following the injury, the sooner they were able to return to duty.

7. In accord with the observations of Leriche we believed the procaine eliminated pain, permitted early mobilization and blocked vasomotor phenomena.

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TREATMENT OF ACUTE KNEE INJURIES

WITH SPECIAL ATTENTION TO THE "WEAK KNEE" SYNDROME[1]

CHALMERS R. CARR
Lieutenant Commander (MC) U. S. N.
and
G. EDMUND HAGGART
Senior Surgeon (R) U. S. P. H. S.

The knee is one of the most frequently injured parts of the body; in fact, in the experience of one of us (C. R. C.), injuries to the knee are seen once or twice a month by the medical officer on general sea duty. No doubt they are even more often encountered by medical officers on duty with troops, especially in such units as paratroops and Seabees. The importance of trauma to this one joint may be evaluated from the statistics of injuries in the Navy during 1940 (*1*). In that year, wherein the average daily strength of the Navy and Marine Corps was 202,614, 15,449 days were lost because of injuries to the knee and its component soft parts. These injuries were listed under various diagnoses such as sprain of the knee joint, traumatic synovitis of the knee joint, rupture of the cruciate ligaments, rupture of the tibial collateral ligament, fracture of the semilunar cartilage, fracture of the cartilages of the knee, dislocation of the cartilages of the knee, contusion of the knee, and internal derangement of the knee joint.

A consideration of these figures, having in mind the size of the Navy today, leads to the conclusion that knee injury, exclusive of combat injuries, is a problem of considerable importance. In discussing causes for survey, McMaster (*2*) reported that at his station in a 6-month period, injury to the knee was second only to flatfoot as an orthopedic cause for inability to perform the duties of recruit training.

Because of the many varieties and gradations of knee injuries, accurate appraisal is essential for satisfactory results. Early, adequate, and prolonged care may prevent later disability. Since the majority of knee injuries do not involve the bones, a normal roentgenologic appearance does not rule out serious damage to the joint. A knee that at first appears to be "sprained" and shows no roentgenologic evidence of injury may have an extensive injury to the soft parts resulting in what may be called the "weak knee" syndrome.

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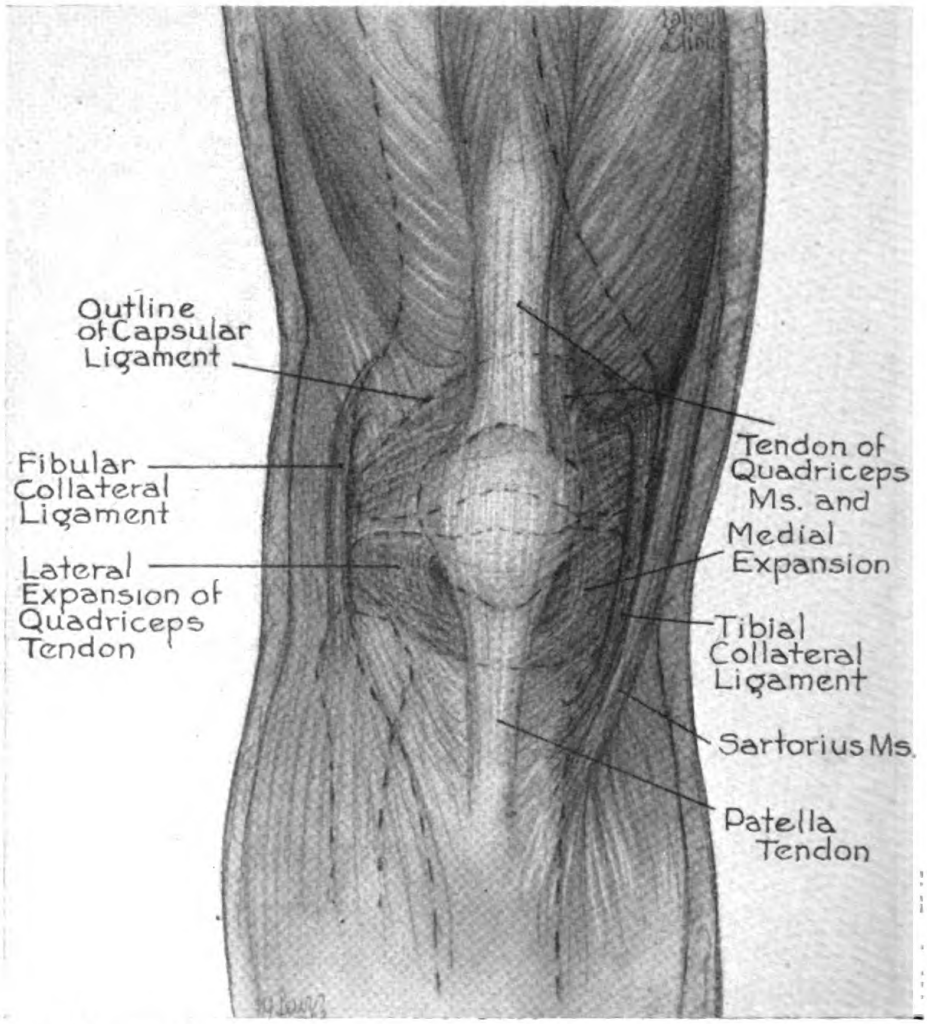
[1] From Naval Postgraduate Unit, Department of Bone and Joint Surgery, The Lahey Clinic, Boston, Mass.

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ANATOMY AND PHYSIOLOGY

The knee is a complicated hinged joint placed between the two longest and strongest bones in the body. It is composed of three joints; two condyloids and an articulation between the patella and the femur. Several recent articles (*3*) (*4*) (*5*) describe motion between the menisci and the tibial condyles. Including these there are five articulations constituting the mechanisms of the knee joint.

The arrangement of the supporting structures is complex, and their detailed relations are outside the scope of this paper. Figures 1 and 2 show the anatomy of the joint and the important supporting struc-



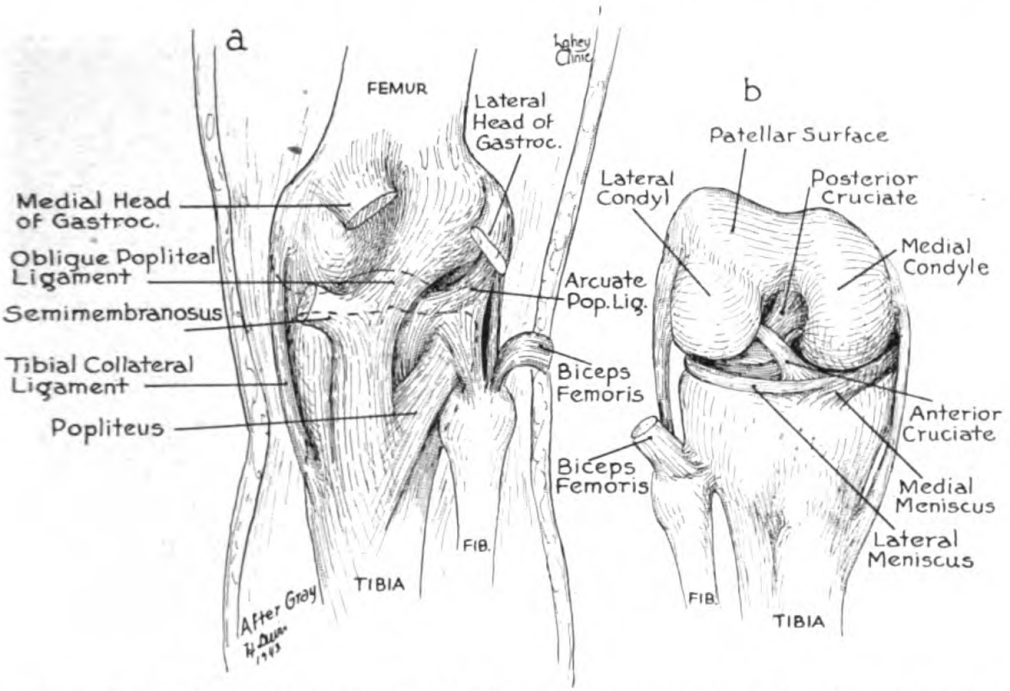
1. Composite drawing showing important structures in the knee joint.

tures. These are (1) the quadriceps tendon with its lateral and medial reflections, blending into (2) the capsule of the joint; (3) the tibial collateral, and (4) the fibular collateral ligament; (5) the medial and lateral menisci; (6) the anterior, and (7) the posterior cruciate ligament; and (8) the oblique popliteal ligament. The

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quadriceps femoris muscle group is not a direct part of the joint but is of the greatest importance.

Recently Brantigan and Voshell (*5*) attempted to clarify the in-



2. Anterior and posterior views of stripped knee joint, showing important ligamentous structures.

consistency in the literature concerning several details of knee mechanics. It is stated that:

The integrity of the knee joint depends upon the muscles and tendons about the knee, the articular capsule, the intrinsic ligaments of the joint, and the bone architecture of the tibia and femur.

Lateral motion of the knee joint in extension is controlled by the capsule, collateral ligaments, and cruciate ligaments; in flexion, by the same structures minus the fibular collateral ligament.

Rotary motion of the knee joint in extension is controlled by capsule, collateral ligaments, and cruciate ligaments; in flexion, by the same structures minus the fibular collateral ligament.

Forward gliding of the tibia on the femur is controlled by the anterior cruciate ligament.

Backward gliding of the tibia on the femur is controlled by the posterior cruciate ligament.

Lateral gliding of the tibia on the femur is controlled by the tibial intercondyloid eminence and the femoral condyles with the aid of all the ligaments.

Hyperextension is controlled by both collateral ligaments, both cruciate ligaments, both menisci, the posterior aspect of the articular capsule, the oblique popliteal ligament, and the architecture of the femoral condyles.

Hyperflexion is controlled by both cruciate ligaments, both menisci, the femoral attachment of the posterior aspect of the capsule, the femoral attachment of both heads of the gastrocnemius muscle, and the bone structure of the condyles of the femur and the tibia.

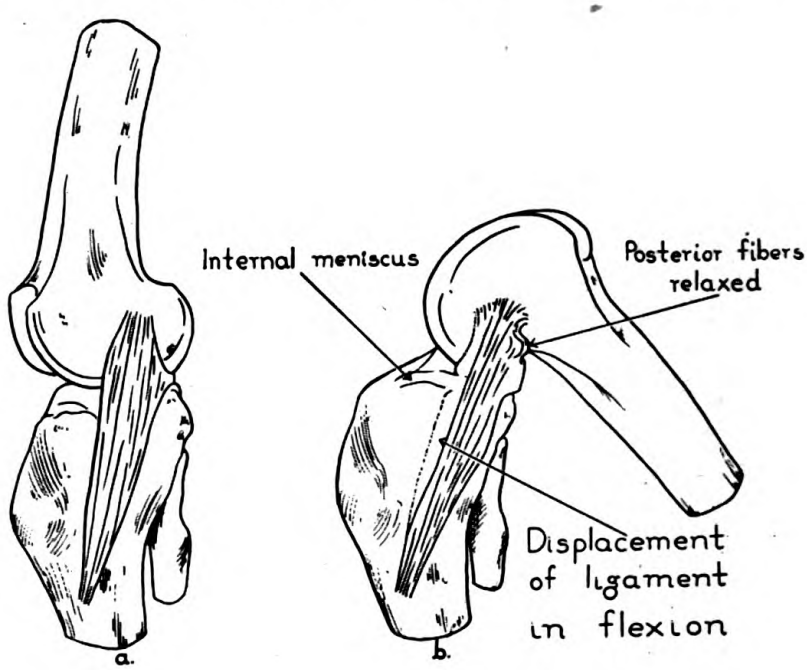
The menisci cushion hyperextension and hyperflexion.

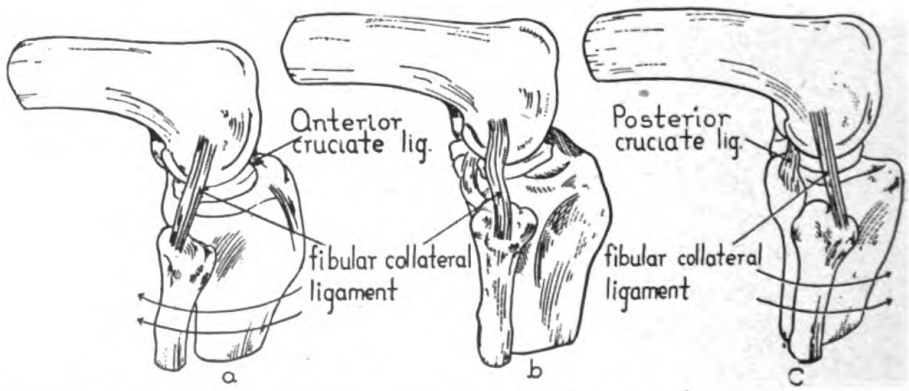
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The tibial collateral ligament is closely related to the medial meniscus, but there is no strong fibrous-tissue attachment between them.

The tibial collateral ligament glides forward and backward in extension and flexion.

The last two statements differ from the general belief that the tibial collateral ligament is attached firmly to the medial meniscus (*3*) (*4*) (*6*) (*7*). On the basis of operative findings a bursa between the liga-





3. Stripped joints showing action of the tibial and fibular collateral ligaments in flexion of the knee joint. (J. Bone & Joint Surg. **23**: 49, January 1941.)

ment and the true capsule (*8*) has been many times demonstrated, the latter structure being intimately attached to the medial cartilage. Figure 3 demonstrates the role of the collateral ligaments in flexion and flexion rotation.

The normal motions which take place in the knee joint are flexion and extension, accomplished by both a hinge action and a gliding motion. In addition, slight rotary motion in full flexion is possible.

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In complete extension, the medial femoral condyle rotates medially and slightly posteriorly, locking the joint, and during this action the condyle wedges the medial meniscus before it. To this is commonly attributed the more frequent injury of the internal cartilage.

The patella glides around the anterior surface of the femoral condyles in a passive fashion. In extending the leg from a flexed position the patella serves as a bearing point and gives leverage to the patella tendon. It further serves to protect the joint and intercondyloid portion of the lower end of the femur from blows and weight-bearing stresses. However the fact that it has often been removed following comminuting fractures, as well as in operations for degenerative arthritis, shows that it is not an essential organ.

Of the muscles acting directly on the knee joint, the quadriceps group is of particular significance. As has been demonstrated frequently the arrangement of the quadriceps muscle is of the greatest importance in maintaining the stability of the joint. Milch (*9*) noted in patients in whom tears of the cruciate ligament were suspected but in whom the "rocker sign" could not be elicited, that with the quadriceps relaxed under anesthesia, lateral and anteroposterior instability of the knee could be demonstrated. Consequently he concluded that the major role of the quadriceps is the maintenance of proper alinement of the joint surfaces. Apparently in the knee the relationship between any two points on apposing joint surfaces is as definite as between the cogs in a set of gears. Any slipping or malalinement produces symptoms of pain, pseudolocking, "giving way" of the knee, and later degenerative changes in the malposed surfaces.

"WEAK KNEE" SYNDROME

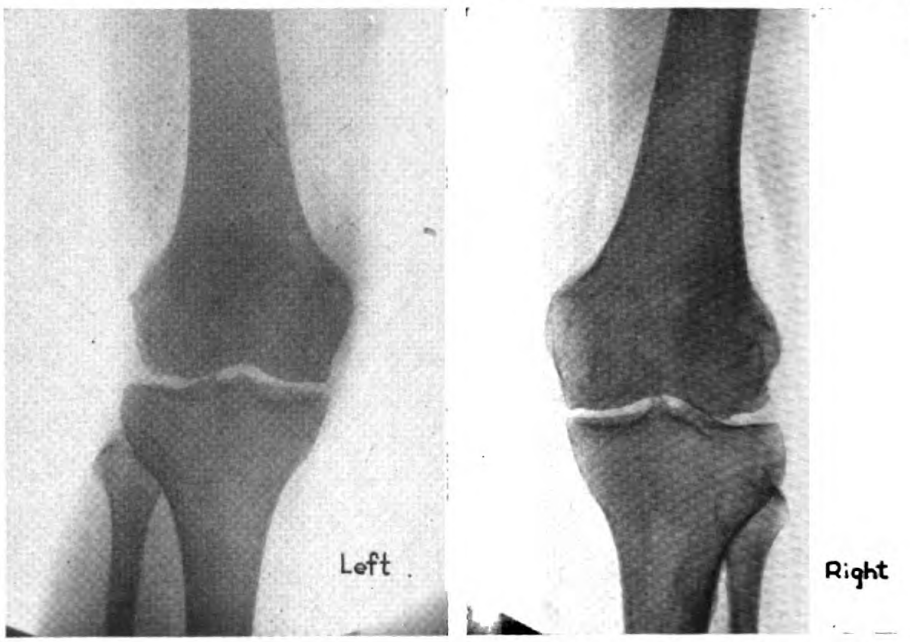
A patient with a so-called "weak knee" may complain of anything from a vague discomfort on weight-bearing to a transient "locking." Overactivity produces an increase of pain, and the disability may vary from slight limitation of certain motions to an almost complete inability to use the joint or bear weight on it. The one constant objective finding is atrophy of the extensor muscles (quadriceps) of the affected thigh. The joint line is often painful to touch, but not necessarily so. A definite or less appreciable hypermotility of the joint in the lateral and anteroposterior planes may exist. Roentgenologic examination usually reveals only generalized demineralization of the bones (fig. 4). In older patients, however, early degenerative changes along the joint surfaces may be discernible.

Although the "weak knee" syndrome long has been recognized by special investigators, we believe its existence and incapacitating character have not been sufficiently impressed upon the general medical profession. Bennett (*10*) described it as a "relaxed knee" and

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pointed out that when ligaments are torn and are healing, atrophy occurs. He gave two causes for locking; first, torn cartilages and loose bodies, and, second, a typical pseudolocking of the knee which occurs without any lesion of the semilunar cartilages or loose bodies, a relaxation of the structures about the internal and anterior surfaces of the knee joint, the fascia, the capsule and internal lateral ligament which permits the articulation to become disengaged and snap back into position.

In 1933, Fisher (*11*) said that the most important factor in the treatment is to build up the quadriceps extensor and other thigh muscles so that they compensate for the weakness and instability caused by the loss of the action of the cruciate ligament. Bishop (*12*),



4. Comparative roentgenograms in a case of advanced "weak knee." Note the marked decalcification of bone, and soft-tissue atrophy in the right knee.

who described the same condition as "quadriceps insufficiency," emphasized that functional use in walking will not suffice but that complete cooperation and prolonged quadriceps exercises eventually will restore normal function. This is true; moreover, walking without knee support will further the atrophy. Watson-Jones (*13*) noted that wasting of the quadriceps muscle was in itself a source of disability and that this occurred as a direct consequence of injury to the knee joint.

Patients with this syndrome are unable to contract the quadriceps muscle voluntarily on the affected side. This function must be restored by teaching the patient awareness of the muscle and its normal action on the joint. Such muscle re-education is successfully taught by physical therapy methods. The patient must be shown the exercises

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step by step, and then encouraged to perform them for a long period of time. Performance then becomes part of the automatic action or motor pattern. The well trained physical therapist is conversant with this principle. Muscle training deserves more attention than it is now receiving; the very earliest possible application will prevent muscle atrophy and reduce the number of days lost from active duty as a result of knee injuries.

TREATMENT OF ACUTE INJURIES TO THE KNEE

An injury to the knee, without laceration or evident external injury, is almost always due to a twisting strain on the extremity with the knee in some degree of flexion. The patient usually hears a tearing or snapping sound, has immediate pain, and the knee may be locked in flexion. When the deeper structures are injured the swelling is rapid and almost immediate. Since several structures usually are involved, it is often difficult at first to evaluate which is the most seriously damaged. Most frequently affected are the internal collateral and the anterior cruciate ligaments, and the next most frequently, the internal semilunar cartilage. Mauck (*14*) believes that in many cases the damage in a semilunar cartilage is secondary to that in the ligamentous structures.

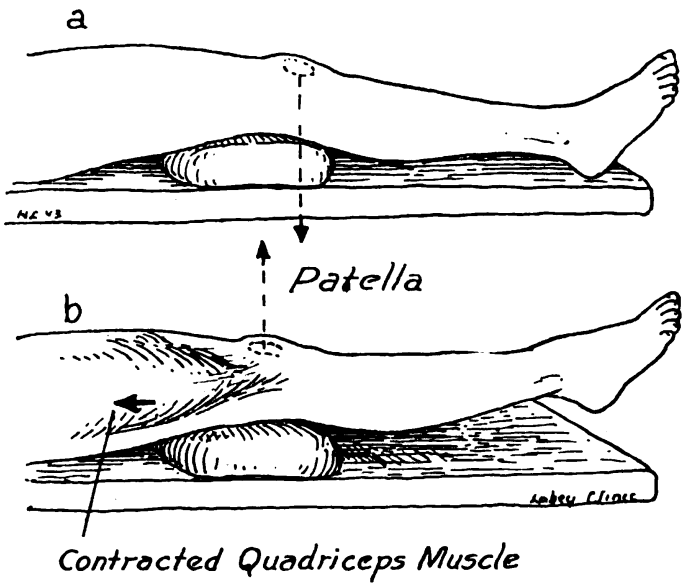
When a recent knee injury is encountered, weight-bearing should be interdicted. The patient should be put to bed and the knee supported with a pillow splint. If the knee was injured within 4 to 6 hours, it should be cooled with ice bags. While this treatment is impossible in the field, it is usually practical aboard ship or in garrison. Complete roentgenologic examination should be performed as soon as sedation has produced a cooperative patient. The diagnosis of injuries involving the tibial spine, linear fracture into the joint space, and avulsion fracture at the ligamentous attachments requires technically perfect x-rays, which seldom are attainable in a patient suffering pain with muscle spasm. Little is to be gained by immediate roentgenologic examination except the disclosure of fractures. It is at least a questionable procedure to transport a patient in pain some distance to procure roentgenograms. Immediate rest and support will do much toward initiating the repair of damaged tissue.

Effusion which is immediate and large is caused chiefly by hemorrhage into the joint space. Cold packs do much to control this reaction, and after a lapse of 12 to 24 hours aspiration of the joint fluid is wise. This should be considered a major surgical procedure and performed under meticulous aseptic technic. After removal of the fluid, the knee should be encased again in a pillow splint and ice reapplied, but if 36 to 48 hours have elapsed since injury an ice

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pack will be practically useless, and a soft compression dressing should be employed. In applying such a dressing, occlusion of the collateral geniculate circulation should be avoided by first wrapping the extremity from the middle of the leg to at least the middle of the thigh firmly with sheet wadding supplemented with gauze pads, and then incorporating this dressing in an elastic type bandage. A tight elastic bandage or ready-made knee cuff applied only to the area of the knee should be avoided. Under these circumstances, control of the swelling averages from 6 to 10 days.

The next important step is active use of the quadriceps muscle, which is begun on the 2d or 3d day after injury and increased as the conditions permit. First, the leg is flexed over a sandbag or



5. Simple extension exercise to initiate quadriceps function in recent knee injury.

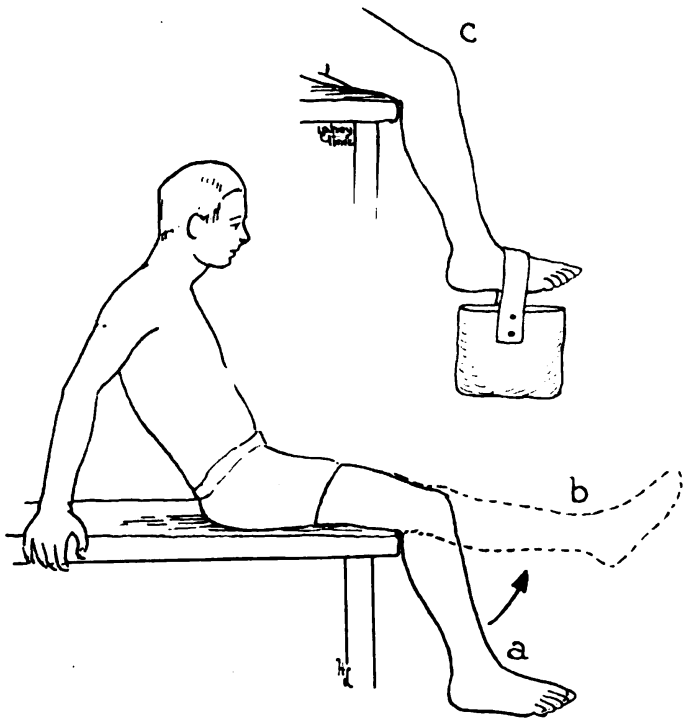
hard pillow and actively extended (fig. 5). As swelling and pain subside the angle through which the leg is extended is increased by addition of more sandbags under the knee. After a considerable angle has been reached, the patient performs the maneuver shown in figure 6, first without, and then with, a weight on the foot, beginning with about 2 pounds and increasing gradually to 10 or 12 pounds.

These exercises should not be regarded lightly, and the nurses and corpsmen should see that they are done thoroughly and regularly. The future outcome of the injured knee and the patient's eventual return to duty may hinge upon such simple maneuvers. The quadriceps extension exercise should be performed several hundred times a day in short installments. To insure that it is properly carried out, it is

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best done by the clock, devoting 10 minutes of each hour to this purpose and recording the maneuver on the patient's record. This impresses its importance on the patient and the ward staff and insures adequate performance.

In any knee injury, full weight-bearing should not be allowed for several weeks. Military considerations will at times alter this procedure, but any compromise should be made with the distinct understanding that the best results are being endangered. After the acute symptoms have subsided, the patient should be allowed up on crutches and on disappearance of the pain should begin gradual weight-bearing



6. Advanced quadriceps exercises. C. In the later stages a weighted sandbag is added.

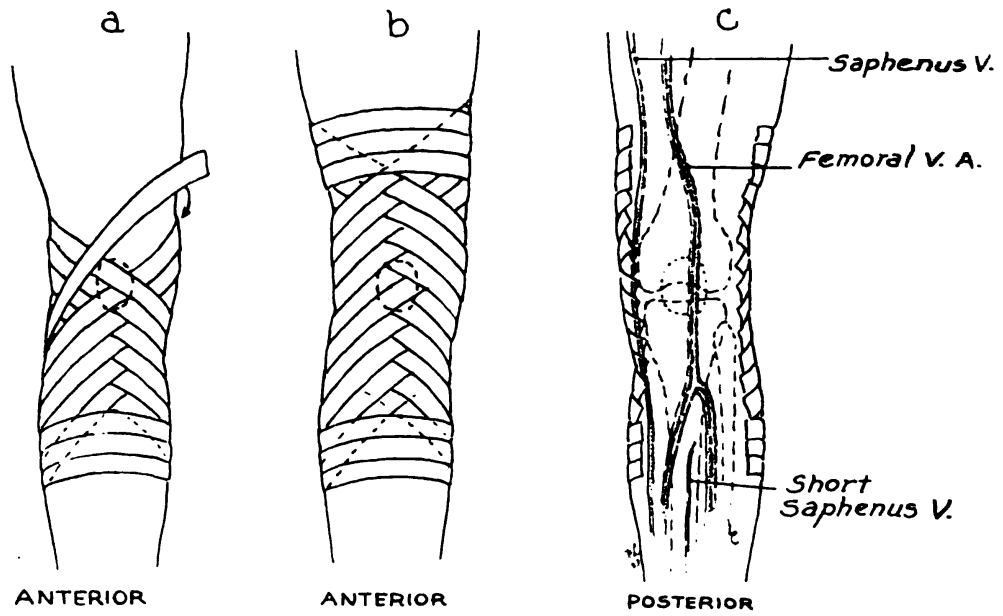
on the extremity. Crutches should be used from 4 to 6 weeks. Too early weight-bearing usually leads to reflex splinting of the muscles and subsequent "weak knee." Delayed weight-bearing, if quadriceps exercises have been active, produces confidence. Whenever available, swimming should be allowed very early for those patients able to handle themselves in the water.

Prior to the resumption of weight-bearing and for a time subsequently we support the joint with an adhesive support (fig. 7). The knee cage advocated by Bennett (*10*) and others is difficult to obtain, and the hinged cast (*14*) has technical disadvantages that are not offset by its advantages. The simple strapping, applied carefully over the shaved leg coated with compound tincture of benzoin, is a comfortable

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and adequate support. With the knee reinforced in this fashion, quadriceps function continues by swinging the whole leg at the hip joint. After resumption of weight-bearing and removal of the support, quadriceps exercises should be encouraged for at least 6 months.

In every knee injury a decision must eventually be made as to the necessity of surgery to restore maximum function. The final opinion should be given by those experienced in joint surgery. Patients with early and persistent locking of the joint, swelling, marked and persistent tenderness along the joint line, recurring or persistent effusion, or a definitely unstable joint, with adequate quadriceps function, should undergo exploration. However, whether or not surgery later is indicated, and in an ever-increasing number of cases it will be, immedi-



7. Knee support by adhesive strapping. C. Note that encirclement of the knee with compression of circulation is avoided.

ate protection and maintenance of quadriceps muscle function will reduce the number of ill advised arthrotomies and pave the way for necessary surgery. Adherence to this plan will do much to reduce the incidence of late and bothersome complaints dating back to a previous knee injury.

SUMMARY

Knee joint disability during Naval service, exclusive of combat injuries and fractures, is frequently encountered.

The anatomy and recent concepts of the mechanics of the knee joint are reviewed, with particular reference to the "weak knee" syndrome.

A program for conservative management of the acute traumatic knee, which we believe will prevent disabling "weak knee" following injury, is outlined.

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ASCITIC FLUID TRANSFUSION

In over 300 ascitic fluid transfusions from the ascitic fluid bank we have found ascitic fluid is a fairly satisfactory substitute for blood or plasma in the treatment and prevention of shock. Approximately twice as much ascitic fluid is used in a case as would be if whole blood were being used.

It is not necessary to cross match ascitic fluid as the agglutination titer in pooled ascitic fluid is low and these agglutinins are sufficiently neutralized by the serum and body cells of the recipient to prevent reactions.

Bloody ascitic fluid should not be used in an ascitic fluid bank. The donor should be suspected of either malignancy or prothrombin deficiency or both. In our experience these donors have failed to respond to adequate amounts of vitamin K.—Editorial. Ascitic fluid bank. Am. J. Surg. 63: 1–2, January 1944.

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INJURIES OF THE SEMILUNAR CARTILAGES OF THE KNEE

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In a previous article in this BULLETIN [1] 40 cases of injuries of the semilunar cartilages of the knee were discussed from the standpoint of diagnosis and treatment. Another approach for complete removal of the meniscus was presented. Postoperative exercise of the quadriceps femoris muscle was advocated as the most important factor for strengthening the knee joint. A résumé of 20 additional cases is herewith presented because of the variety of pathologic changes encountered, bringing the series to 60 cases. These additional cases include 9 uncomplicated cartilage injuries, 3 cysts of the external cartilage, 3 osteochondritis dissecans, 2 internal lateral ligament avulsions, 1 external lateral ligament avulsion, 1 hypertrophied fibrous fat pad, and 1 external cartilage associated with a low back injury.

In the uncomplicated cases, 5 bucket-handle tears, 3 torn cartilages, and 1 loose cartilage were seen. Three cysts of the external cartilage were encountered. In each there was a history of injury. Two were trivial twists which passed unnoticed because they were not incapacitating at the time. The third patient gave a history of repeated injuries in football, necessitating aspiration for water of the knee. In all the pain was usually aching in type and associated with stiffness, but swelling was the main concern. The duration of this swelling varied from 1 to 16 weeks. In each instance admission examination revealed a tender, nonmovable mass in the area of the external lateral ligament at the joint line. The mass became more prominent upon complete extension of the leg. One of the cysts was firmly adherent to the under surface of the external lateral ligament, necessitating a transverse incision of the ligament to excise the external cartilage and cyst. In the other cases the cysts were exposed by a triangular incision of the fascia lata extension with the base parallel to the joint line. The cysts were approximately 1 inch wide and ovoid in shape.

[1] PETERSON, T. H., and LILLE, J. J.: Injuries of semilunar cartilages of knee. U. S. Nav. M. Bull. 41: 1336–1338, September 1943.

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The average hospital stay was 43 days. Recovery was uneventful and all three patients were returned to duty with good functioning knees.

A Baker's cyst associated with an osteochondritis dissecans was another type encountered. Examination of the patient showed a hard nodule on the medial aspect of the left joint line. This mass was especially prominent when the knee was in complete extension. Through an anterior approach a loose cartilaginous body ¾ by ½ inch was removed from the inner left knee joint. A defect was present on the lateral aspect of the medial condyle. Posteriorly, by a longitudinal incision through the midpopliteal fossa a cyst 1½ by 1 by ¾ inches was excised. This tumor was adherent to the medial head of the gastrocnemius muscle and the posterior aspect of the capsule of the joint. The patient returned to duty in 26 days.

In attempting to explain the etiology of the two lesions we feel that either at the time of the original injury or soon thereafter a perforation must have occurred in the posterior capsule with the growth and proliferation of the synovial membrane into the popliteal fossa. After formation of the cyst the sinus was "pinched off" at the posterior capsular margin, causing an atresia at this point.

There were three cases of osteochondritis dissecans with some unusual aspects. A Marine officer, who had been wounded by shell fragments in the right knee, had had extra-articular fragments removed. An osteochondritis defect on the medial condyle of the femur was curetted. It is believed that this defect had existed prior to the injury. Two months later the patient complained of "locking" of the right knee when it was completely extended, whereupon he would flex the knee until a "click" was heard. He complained especially of pain upon going upstairs. Physical examination revealed effusion and tenderness at the medial joint line anterior and posterior to the internal lateral ligament.

At operation an osteochondritic defect was disclosed on the lateral aspect of the medial condyle measuring three-fifths inch in diameter. The crater was filled with a yellowish gelatinous fluid. The anterior and posterior portion of the medial meniscus would slip into the intercondylar notch and the osteochondritic defect when the leg was fully extended, and slip out when the knee was flexed. This coincided with the patient's explanation of reducing the "locking."

The second patient was in the engine room when his ship was struck by a torpedo. The force of the impact threw him forward with his knees flexed, but he did not strike the deck, as his fall was broken by his outstretched hands striking one of the bulkheads. Since then he had had swelling and pain in the knee, the latter aggravated on bending. Physical examination showed a swollen knee and tenderness at the joint line medially and laterally which was

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more pronounced on the medial aspect. He was unable to flex the knee more than 90° from the position of complete extension. Movements of the knee produced a grating sound.

Operation disclosed a defect on the medial condyle in the midportion about ½ inch in diameter. The medial meniscus was detached anteriorly. The articular cartilage of the entire medial condyle was paper thin and separated practically in its entirety, thus forming a potential space between the bone and the cartilage. The anterior cruciate ligament was torn off the medial tibial spine. The patient developed a deep postoperative phlebitis which was treated by bed rest. Ninety-nine days postoperatively he had moderate edema of the foot, leg, and knee, with some weakness of the knee.

The third patient had an osteochondritic defect 1 cm. in diameter on the lateral aspect of the medial condyle and a detached medial cartilage. The cartilage was excised and the defect curetted. Thirty-three days after operation the patient was discharged to duty with good function in the knee.

Two external and one internal ligament tears were seen. The first patient injured his knee playing football. On this occasion the knee locked and became edematous. Seven months later the patient was climbing a ladder when his knee locked again. Seven days later he was seen at the hospital, complaining of stiffness of the right knee and sharp pains radiating down the outer side of the right leg. Examination revealed diffuse tenderness over the medial and lateral aspects of the knee, but there was only slightly increased mobility when the knee was abducted.

At operation a transverse avulsion of the external cartilage at the junction of the proximal and middle third was found. The external ligament was torn 1 inch from the femoral attachment. However the fascia lata expansion about the knee joint was intact. This accounted for the failure to obtain increased mobility of the lateral knee joint in abduction. The cartilage was removed and a tongue of the fascia lata was attached to the tibia according to the Campbell technic. Seventy-three days after operation the patient had complete extension and flexion of the knee with good stability of the external ligament. However he still complained of slight weakness when he was on his feet too long.

An internal ligament avulsion occurred in a shore patrol officer while running. He fell with his left leg pinned under him in adduction and was unable to rise. Examination showed marked swelling and ecchymosis of the inner aspect of the left lower thigh and knee, with marked increased mobility upon adducting the knee. At operation an avulsion of all the fascial planes with marked hemorrhage into the soft tissues was found. The internal lateral ligament was detached ½ inch from its tibial insertion. The medial cartilage

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was loose at the periphery in the middle third. The anterior cruciate ligament was lying free in the intercondylar notch. The cartilage was removed. The proximal portion of the internal lateral ligament was passed through a tunnel on the medial aspect of the tibia subperiosteally and doubled back on itself. The distal end was sutured to the underlying proximal middle third of the ligament. The ligament at the tibia was sutured to the adjoining semimembranous tendon. Seventy days postoperatively this patient was walking about with medial stability of the knee. He could flex his knee only 90°. By the use of physiotherapy and active motion, it is thought that the flexion will be increased gradually to within normal limits.

The third patient, while climbing out of an airplane, caught his left leg in a stirrup step and fell to the ground. His history was of interest in that when walking he had pain in his left knee associated with a feeling of nausea. Operation disclosed the internal lateral ligament torn ½ inch from its femoral attachment. In this case it was possible to approximate the ends of the ligament. The internal cartilage which was loose in its anterior two-thirds was removed. Three months after operation the patient returned to duty with complete motion of the knee.

One of the cartilage injuries was sustained when the patient fell on the ice injuring the right side of his back and right knee. Two weeks later, at the hospital, he complained of right-sided low-back pain with radiation down the posterior thigh to the knee. The patient described the back pain as a "soreness," the sciatic pain as "throbbing." Physical examination revealed limited movements of the lumbar vertebrae and lumbosacral junction with left paralumbar muscle spasm. The sciatic nerve was tender in the left gluteal area between the greater trochanter and the sciatic tuberosity. The leg could be extended 45°. The operative procedure consisted in a left hip cuff, using 10 cc. of 1-percent procaine hydrochloride.

Eight days later the patient had no back pain but he walked with a limp. Upon repeated examinations a persistent tenderness was found over the left anterior tibial external surface at the joint line. An arthrotomy demonstrated a loose external cartilage which was excised. The patient is now symptom-free; he has good knee motion and is scheduled to return to duty.

Another patient gave a 5-year history of his left knee "giving way" with a questionable locking. He also had pain on the inner side of the knee. A small tender mass was palpable at the joint line on the anteromedial aspect of the knee. Arthrotomy disclosed a hypertrophied fibrous fat pad with one loose tab extending into the intercondylar notch. The internal cartilage was normal. The fibrous tab was excised. The patient made an uneventful recovery and was returned to duty in 52 days.

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EYE CASUALTIES TREATED ON A HOSPITAL SHIP

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The following report of the activities of the ophthalmologic service aboard a hospital ship during war is based upon the study of 7,993 patients. Of this number, 3,019, or 38 percent, were admitted because of injuries directly due to combat, while 4,974, or 62 percent, were admitted because of disease, injury, or disability not directly due to battle action.

Eye injuries of varying severity were encountered in 451 patients, or 15 percent of the 3,019 war casualties. Table 1 shows the origin of these injuries.

TABLE 1.—*Origin of 451 eye injuries due to combat*

Burns	212	Torpedo	4
Shrapnel	87	Bayonet	3
Blast	36	Landmine	3
Debris	31	Explosion K gun	2
Gunshot	24	Explosion detonator E motor	1
Aerial bomb	16	Explosion steel butane tank	1
Hand grenade	12	Explosion 20-mm. shell in handling	1
Mortar shell	9		
Aircraft fragments	9	Total	451

Of the 451 patients with eye injuries, 47 percent were Naval personnel, 43 percent Marines, and 10 percent Army.

While patients transported by air reached the hospital ship within 8 hours, the majority were admitted from 3 to 8 days after injury. They were retained aboard ship for intervals varying from 36 hours to as long as 6 or 8 days. When active evacuation was not in progress, patients were of necessity retained aboard ship for longer intervals. Except in a few instances we were unable to follow the progress of our patients after they left the ship and for this reason are unable to furnish detailed data regarding end results. In most cases of eye injury, adequate and satisfactory temporary measures had already been carried out before admission.

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Eighty percent of the casualties with eye injuries also had other wounds, the general nature of which are shown in table 5. Keen judgment and thoroughness in examination of battle casualties are necessary to avoid two pitfalls. First, there is the tendency to direct exclusive attention to other major wounds so that serious damage to the eyes may be overlooked. Although there may be multiple shrapnel wounds, amputation of a limb, or compound fractures, a determined effort should be made to search out eye injuries that they may receive early and adequate treatment. This necessitates close cooperation on the part of the general surgeon, the orthopedic surgeon, and the internist who may be the first to see the patient.

Second, undue emphasis may be placed on eye injuries with failure to recognize other and more serious wounds. Minor injuries to the eyelids or periorbital tissues are followed by so much edema and ecchymosis that the patient may be brought first to the attention of the ophthalmologist in spite of the fact that more important wounds are present elsewhere.

In the face of rapidly mounting casualties, the care of all wounds may be temporarily the responsibility of the ophthalmologist. For this reason he should be familiar with the accepted methods of treating major wounds, burns, and fractures, and the patient must be regarded as a whole and not from the point of view of an interesting ophthalmologic problem.

On admission, the appearance of a patient was often deceiving. In the absence of obvious changes in the lids or globes, superficial examination so frequently overlooked serious eye injuries, that it was found expedient not only to examine the globe and orbital region but also the mouth, nose, sinuses, head, and neck for wounds of entrance. It was not unusual for obscure ocular damage to be recognized only after the determination of visual acuity, ophthalmoscopic examination, muscle balance tests, and neurologic or roentgenologic examination.

INJURIES TO THE EYELIDS

Injuries to the eyelids were very common. Burns were encountered more frequently than lacerations or puncture wounds, and avulsion of the eyelid by bullets or shrapnel was comparatively rare.

Burns.—Burns of the eyelids were found in 212 patients, 27 of whom also had burns of the cornea or of the cornea and conjunctiva. Burns of the lids were almost invariably flash burns and less than 2 percent were due to steam or burning gasoline and fuel oil.

Prior to admission to the hospital ship, the treatment of burns of the eyelids tended to be identical with whatever treatment had been used on burns elsewhere on the body. Such treatment ranged from

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tannic acid preparations, gentian violet and other dyes, powdered sulfonamides or ointments, to wet dressings of boric acid solution. The tough coagulum produced by the tannic acid preparations and most of the dyes was particularly distressing because it interfered with the mobility of the eyelids and tended to cause distortion of the lid margins with exposure of the cornea and conjunctiva to drying and the entrance of foreign bodies. Moreover, purulent secretions forming beneath the crusts favored erosion of the lids and further destruction of tissue.

The most satisfactory primary treatment of burns of the eyelids consisted of thorough cleansing of the burned area with soap and water, with special attention to the removal of excess medicaments, crusts, debris and such necrotic material as could be removed without producing bleeding. When cleansing had been completed, continuous wet compresses of saturated boric acid solution or physiologic saline solution were applied. The additional application of microcrystalline sulfathiazole powder several times a day prevented desiccation and distortion of the lids, stimulated repair and encouraged local circulation. Sulfonamide powders, ointments, and pastes, or merely wet dressings of boric acid solution appeared to be superior to all other medicaments. In those instances where continuous wet dressings are not practical, sulfathiazole ointment (water-soluble vanishing cream base) may be applied liberally, and the old medicament removed daily prior to the application of fresh ointment. Daily irrigation of the conjunctival sac ensures the removal of accumulated debris and should be followed by the introduction of ophthalmic ointment of butyn sulfate 2 percent and metaphen 1:3,000 or merthiolate 1:5,000 into the sac.

When the cornea or conjunctiva are exposed because of lid contraction or deformity, a protective shield prepared from old roentgen film may be used to advantage. Early Thiersch grafting of areas showing extensive epithelial loss prevented or at least minimized ectropion.

Wounds.—Wounds of the eyelids, in their order of frequency, consisted of lacerations, puncture wounds due to debris, and small shrapnel fragments or other metallic particles. In a few cases, one or both lids had been entirely torn away by shrapnel or bullets. It was found advisable to examine the globe and orbit meticulously for injury or foreign body whenever such injury to the lids was present. Occasionally, one or more foreign bodies in the globe or orbit were found by roentgenologic examination when the only apparent injury was a minute lesion of the eyelid which led to an equally minute traumatic wound of the globe. No inflammatory reaction and no ophthalmoscopic evidence of injury to the eyeball had been evident. Emphysema

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of the lids occurred when the wound communicated with the ethmoidal cells and was marked when the patient had indulged in forceful blowing of the nose after injury.

Cicatricial contraction and abnormal tissue masses following lacerations of the eyelids may cause sufficient corneal irritation to endanger the eye itself. These unfortunate sequelae may be minimized or prevented by prompt repair based on sound anatomic principles. Promptness is especially important when the lid margins are involved. The only justifiable delay is the necessity to cleanse the wound thoroughly and to assure by roentgen examination the absence of radiopaque foreign bodies in the immediate field. Before actual suturing is attempted, the wound surfaces should be sprayed with a thin coating of microcrystalline sulfathiazole powder. Early closure is rarely prevented by the presence of infection.

Inattention to fundamental anatomic considerations is often responsible for subsequent ptosis, extensive scarring, ectropion, or posttraumatic notch of the lid borders. While injuries running parallel to the fibers of the orbicularis muscle produce slight deformity, those running perpendicular to the fibers of the muscle are followed by gaping of the wound and extensive scar formation. Repair of the orbicularis is essential for a good cosmetic result. Lacerations extending vertically through the entire thickness of an eyelid are especially serious because of later indentation of the border or deep triangular inversion of the eyelid. Distortion of this magnitude prevents closure of the lids and permits the cornea to be subjected to friction and drying. Ptosis may be prevented by suturing of the levator and tarso-orbital fascia.

Much attention has recently been directed toward the technic of such repairs. In this group of patients we were particularly impressed by the value of the following procedures:

1. The use of an intramarginal suture.
2. Closure of conjunctival wounds to prevent adhesions to the globe.
3. An additional suture near the cilia to prevent notch formation.
4. The accurate approximation of the skin edges.

Many varieties of suture material are necessary in the repair of the lids, but we wish to direct attention to the value of wire suture in obtaining precise approximation of the skin margins.

Our experience corroborates the opinion held by others that pressure dressings are of great importance following repair. However, we feel that daily inspection, followed by the reapplication of fresh clean pressure dressings is superior to nonintervention over a period of from 4 to 6 days.

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CORNEAL INJURIES

Corneal injuries were next in frequency to those of the eyelids. It is interesting to note that burns of the cornea and conjunctiva were found in but 27 of a total of 212 patients with burns of the lids.

If the patient was conscious at the time of the exposure, flash burns were prone to involve only the lids, but if the patient was unconscious the cornea and conjunctiva were apt to be involved. In most of the latter group, the entire corneal surface of both eyes was opaque. However, even though Bowman's membrane had been involved, all but 3 of our patients with corneal opacity due to burns eventually showed regeneration of epithelium and fairly clear corneas. In 3 patients, burns of the cornea were followed by serious scarring, and in 2 of these ectasia resulted. The visual acuity in one individual was 3/20 in each eye after healing was complete. The actual involvement of the cornea was usually superficial and in no instance was there sufficient destruction of the cornea to permit the escape of aqueous.

Shrapnel fragments were responsible for the greater number of lacerations, perforations, and foreign bodies in the cornea. Other causes, in order of frequency, were flying debris, hand grenade fragments, mortar shell fragments, torpedo explosions, and bayonet.

Lacerations.—Lacerations of the cornea responded best to the most conservative measures. The removal of debris and old medication, followed by 5-percent suspension of microcrystalline sulfathiazole, butyn sulfate 2 percent and metaphen 1:3,000 or merthiolate 1:5,000 ointment in the conjunctival sac, and continuous warm compresses were sufficient to induce prompt healing. Suturing of the lids, care being taken that the sutures were not over the cornea, was often all that was required for uneventful healing.

In extensive lacerations, apposition of the corneal edges was possible only by suturing. By far the best material for this purpose is human hair. Our material was obtained from nurses aboard the hospital ship. There is great variation in the texture of human hair, the difference between fine and coarse hair being as much as 25 diameters. The finest hair available should be chosen. Apposition accomplished, a Kuhnt conjunctival flap was used to cover the entire length of the corneal wound and each margin of the flap was anchored by a conjunctival suture.

Perforations.—Perforations tended to close promptly unless too large. The main problems were combating adhesion of the iris and correcting prolapse. It was often possible to enter the anterior chamber through an incision near the limbus and free the iris from its attachment to the cornea. This procedure should be done only if the separation can be brought about without undue trauma. If the protruding iris could not be replaced it was cut away.

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NONPERFORATING INJURIES OF THE GLOBE

Nonperforating injuries of the globe consisted mainly of those due to concussion, compression, or rupture.

Concussion.—Concussion due to blast may occur while an individual is on land, aboard ship or aircraft, or in the water. A distinction has been made between atmospheric blast and immersion blast injury because the critical distance from the center of detonation of a given charge of high explosive is four times as great in water as in air. Furthermore, while there are three components in the compound blast wave in air, blast injuries in water are produced by a single pulse of pressure. The sudden compression and expansion of air or the high-pressure wave in water produce injuries proportional to the proximity of the victim to the center of detonation and the magnitude of the charge of high explosive. Distance largely determines whether there occurs profound damage, minor and temporary changes or no damage at all. Most of our patients with retinal detachment and tears in the choroid had been subjected to immersion blast in contrast to those exposed to atmospheric blast.

Many ocular injuries due to blast are unrecognized for the following reasons:

1. The fundus changes are apt to be transient and can only be found by ophthalmoscopic examination.
2. Ophthalmoscopic examination is difficult or impossible under stress of continuing combat or rescue operations.
3. Evidences of minor damage may disappear in 10 days to 2 weeks and are not found unless looked for early.
4. Service personnel tend to ignore or to attribute dimness of vision and nyctalopia to fatigue or exposure and fail to report their symptoms.

The commonest finding in those exposed to blast is subconjunctival hemorrhage. The majority of these also exhibit changes in the fundus which may be transient or profound. The victim experiences sudden dimness of vision, sometimes amounting to an almost total loss of central vision lasting from several days to several weeks, with eventual recovery the rule. Photophobia and night blindness are almost invariably present. One of our patients subjected to immersion blast presented an opacity of the posterior cortex of the lens of each eye.

Thirty-six patients were admitted to this service primarily because of ocular symptoms subsequent to blast. It should be noted that many other patients had minor blast injuries to the eyes which were not recorded, or who could not be studied because of other injuries demanding immediate attention.

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In 31 patients ophthalmoscopic examination revealed hyperemia of the disc, with blurred margins and slight elevation. The elevation of the disc never exceeded one or two diopters. In 5 patients the disc could not be observed because of hemorrhage into the vitreous. The veins tend to appear overfull, but there is no characteristic change in the arteries. Hemorrhages in the retina were observed in 5 patients, and they had scotomata coincident with the hemorrhagic areas. Two patients subjected to immersion blast had detachment of the retina. In one, there was bilateral detachment in the superior nasal quadrant, while in the other there was unilateral detachment in the inferior temporal quadrant near the ora.

Two patients, one subjected to immersion blast and the other to atmospheric blast, had ruptures at the macula with loss of central vision. Immersion blast produced curvilinear tears in the choroidal vascular membrane in three patients, while, in another, atmospheric blast had produced detachment of the choroid by what was apparently a serous effusion in the suprachoroidal area. One patient with proptosis from retrobulbar hemorrhage and with hemorrhages into the vitreous suffered immediate and total loss of vision.

Compression injuries.—Compression injuries to the globe were noted in 16 patients. Subconjunctival hemorrhage was an almost invariable accompaniment of these injuries. Five patients had hemorrhage into the anterior chamber in addition to subconjunctival hemorrhage, and in 2 of these there was a firm clot in the anterior chamber. Paracentesis was not of value in the treatment of hemorrhage into the anterior chamber, and in fact it may be definitely contraindicated. The use of miotics, particularly of eserine, and heat was sufficient to produce eventual clearing of the anterior chamber in all of our patients. Even the firm clots had undergone dissolution and absorption within a week to 10 days.

Three patients developed traumatic keratitis. Although multiple folds were observed in Descemet's membrane, the cornea returned to normal in each patient. Rupture through the tissue of the iris was noted in four patients, but there were none with iridodialysis. We did not observe subluxation or actual dislocation of the lens in this group of patients. In four there was extensive hemorrhage into the vitreous and two other patients had ruptures of the choroid near the macula while one other had a small retinal detachment. None of our compression injuries had occurred with sufficient violence to perforate the cornea or rupture the sclera. Edema of the orbital tissues was not uncommon, but we saw no patients with sudden retrobulbar hemorrhage and total loss of vision or subsequent optic atrophy.

Rupture of globe.—Rupture of the globe by indirect explosive action may follow the entrance of a projectile or fragment entering the

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orbit with high velocity even though it does not make direct contact with the globe. Two of our patients exhibited such destructive action, one as the result of the passage of a machine gun bullet through the orbit behind and below the globe. The other was struck by a metallic fragment during a torpedo explosion. The machine gun bullet had produced an explosive action in the globe, shattering it into small pieces. The torpedo fragment entered through the anterior wall of the right antrum, passed upward through the floor of the orbit and then penetrated the lateral wall of the orbit producing a large temporal wound of exit. The path of this transfixion wound did not include the globe but there was a stellate tear, above and to the nasal side of the corneoscleral margin. Subluxation of the lens, iridodialysis and massive hemorrhage into the vitreous accompanied this injury.

The lacerated globe is usually considered to be less apt to suppurate than the shattered globe, and therefore the uveal tract is not destroyed by the lytic action of the suppurative process. In this event the residual uveal tissue is thought to initiate sympathetic ophthalmia. On the other hand, fragmentation of the globe is usually followed by suppuration of the uveal fragments, resulting in their eventual destruction and eliminating the possibility of sympathetic ophthalmia from this source. It is pertinent therefore to point out that the early administration of sulfonamides in the field may delay or prevent the suppuration of the uveal fragments and indirectly lead to sympathetic ophthalmia.

PERFORATING INJURIES OF GLOBE

Perforating injuries of the globe may consist of a single wound of entrance or there may be double perforation, as when a foreign body enters the anterior globe and penetrates to the posterior orbit. In every perforating wound it is necessary to establish the presence or absence of double perforation as well as to determine if possible the presence or absence of a foreign body. All of our patients with penetrating wounds of the eye or adnexa received a booster dose of tetanus toxoid, adequate doses of sulfonamides by mouth, and when indicated, intravenous typhoid vaccine.

In two patients, foreign bodies first entered the orbit and then penetrated the globe posteriorly. In each of these there was reduced ocular tension, folds in Descemet's membrane, deepening of the anterior chamber with depression of the iris, hemorrhage into the vitreous, and detachment of the retina. In one of these patients enucleation became necessary, but in the other there was partial recovery with the injured eye showing a visual acuity of 12/20 and a residual scotoma at the site of the retinal detachment.

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FOREIGN BODIES

Foreign bodies which concern the ophthalmologist may be in the eyelids, globe, orbit, or in the neighboring tissues after traversing the globe or orbit. One hundred thirty-six casualties (30 percent of the total number of eye casualties) had such foreign bodies, in the sites shown in table 2.

TABLE 2.—*Sites of foreign bodies in 136 eye casualties*

Cornea alone	26	Cornea and vitreous	8
Posterior orbit	18	Eyelids and orbit	7
With destruction of globe	12	Conjunctiva and sclera or choroid	6
With minor injury to globe	6	Vitreous	4
Cornea and conjunctiva or sclera	16	Globe (with destruction)	4
Globe and orbit	14	Anterior chamber	3
With destruction of globe	8	Lens	3
Without destruction of globe	6	Iris	2
Extraorbital (10 with destruction of globe)	12	Posterior chamber	1
Eyelids alone	12	Total	136

Foreign bodies were extraorbital in 12 patients, while in 124 patients they were in the eyelids, globe or orbit. Of these 124 patients, single foreign bodies were present in 61, and multiple foreign bodies in 63. Both sides contained foreign bodies in 23 patients, and they were confined to one side in 101 patients.

In only 19 patients were foreign bodies retained in the eyelids. Most of these have sufficient initial velocity to carry them to deeper structures. Of our patients with foreign bodies, 19 percent had them in the cornea alone, 12 percent in the cornea and conjunctiva or sclera, and 6 percent in the cornea and vitreous.

Few foreign bodies were found in the anterior chamber because if the force was sufficient to traverse the cornea, the foreign body was carried into the iris, lens, vitreous or orbit. When fragments penetrated to the posterior orbit, there was almost invariably destruction of the globe. In 2 patients, however, with double perforation of the globe, the cornea, iris, lens and nerve head had escaped injury. Although the foreign bodies in the orbit were not removed, the only residual abnormality in each consisted of scotoma coinciding with the site of the posterior perforation.

Of 10 patients in whom extraorbital foreign bodies had damaged the globe and orbit in transit, all suffered destructive injuries to the globe requiring eventual enucleation or evisceration. Three of these patients had wounds of entrance in the globe near the inner canthus, and in each the foreign body was located in the ethmoidal labyrinth of the same side. In the other patients the foreign bodies were distri-

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buted as follows: 2 intracranial, 2 superior maxilla, 1 sphenoidal sinus, 1 near the third cervical vertebra, and 1 in the nasal fossa.

The sites of wounds of entrance of foreign bodies in 136 eye casualties are shown in table 3.

TABLE 3.—*Sites of wounds of entrance of foreign bodies in 136 eye casualties*

Cornea	47	Globe (outside limbus)	19
Eyelids (to globe or orbit)	17	Extraorbital	13
Eyelids and cornea	16		
Cornea and bulbar conjunctiva	24	Total	136

Little value can be attached to statistics concerning the incidence of foreign bodies or the ratio of nonmagnetic to magnetic foreign bodies. Such figures vary widely not only according to the time and place of action but also in successive engagements. Following one sea battle, over 90 percent of the foreign bodies examined proved to be magnetic, and yet the casualties received a few days later from another action presented foreign bodies that were almost exclusively of aluminum or glass.

At least one-half of the entire number of the foreign bodies proved to be magnetic. Most of these were shrapnel fragments. A clue as to the nature of intraocular or intraorbital foreign bodies may be obtained by examining others which are superficial and accessible in the head, trunk, or extremities. The same patient, however, may present foreign bodies of widely divergent origin. Even though a fragment may be known to be magnetic, its removal by magnet may be impossible because it has become enmeshed in inflammatory exudate or newly formed tissue.

Aircraft combat and destruction of aircraft on board ship or on the ground account for a high percentage of aluminum and glass foreign bodies. Glass and aluminum fragments produced practically no reaction in the absence of infection, but ferrous and copper fragments not only produced intense reactions but also staining of the contiguous tissues. All of our patients with brass fragments were received early and we were unable to discern characteristic reactions in the tissues.

Many foreign bodies, particularly those of aluminum or glass are not sufficiently radiopaque to be demonstrated by x-ray examination, and their presence may first be discovered by slit lamp or ophthalmoscopic examination or even by probing. Glass combined with heavy metals such as lead is an exception to this. In one of our patients, an aluminum fragment measuring 35 mm. in length, 0.4 mm. in thickness, and varying from 2.5 to 11 mm. in width, was found along the floor of the orbit when we probed the wound of entrance in the lower lid. In reviewing the films of this patient,

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we still were unable to detect the presence of the foreign body although we knew its exact location.

The nature and origin of foreign bodies retained in the eyelid, globe, orbit or neighboring tissues (after damage to ocular structures) are shown in table 4.

TABLE 4.—*The nature and origin of foreign bodies retained in the eyelid, globe, orbit, or neighboring tissues (after damage to ocular structures)*

Material	Number of patients	Origin	
Ferrous (magnetic)	68	Shrapnel	36
		Hand grenade [1]	8
		Mortar shell	8
		Machine gun bullets	7
		Aerial bomb	6
		Shell explosion	2
		Shattered steel plate	1
Unidentified (probably largely unexploded powder or high explosive).	31	Shell fire	19
		Aerial bomb	9
		Hand grenade	3
Aluminum (all occurred aboard ship or aircraft).	12	Shell explosions on deck	8
		Shell explosion in wardroom	2
		Shell explosion on bridge [2]	1
		Aerial bomb	1
Brass	11	Shell explosion aboard ship	8
		Shrapnel bomb	2
		Gun explosion	1
Powder granules or unexploded high explosive fragments.	6	Gun explosion aboard ship	5
		Shell exploded while handling it	1
Glass	4	All received in aircraft while in aerial combat.	
Copper	3	Hand grenade	2
		Machine gun strap shattered by bullet	1
Eyelash and unidentified foreign body	1	Blast	1
Total	136		

[1] One of these patients also had several small foreign bodies of copper.

[2] This patient also had a few small ferrous foreign bodies in addition to the aluminum fragment.

Localization.—Localization of foreign bodies requires ingenuity of a high order. Superimposition of bony structures in the x-ray may often mask the presence of fragments of equal or less density than the superimposed structures. Multiple or stereoscopic films may, therefore, reveal a foreign body invisible in a single projection.

Specially built mechanical aids such as those of Sweet or Coburg as well as proper needles for the injection of air into the capsule of Tenon to outline the globe by contrast were not available to us. In many instances, the use of these methods would have been impractical because of: (1) Varying degrees of proptosis consequent to a foreign body in the posterior orbit with retrobulbar edema; (2) marked edema of the lids; and (3) the difficulty of identifying multiple metallic splinters in successive films. It was necessary for us to rely on simple methods such as opaque corneal and scleral markers or clips fixed to the skin about the eye.

An approximate idea of whether a fragment was in the globe or in the orbit could sometimes be obtained by affixing ordinary surgical clips to the skin. By projecting a millimeter rule, a clip could be

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placed 24 mm. posterior to the anterior surface of the cornea thus marking the posterior limit of the globe. Two clips, 23.5 mm. apart and equidistant from the visual axis, could be used in the upper and lower lids to approximate the vertical diameter of the globe. Because there is considerable variation of global dimensions in different individuals, this technic lacks value when the fragment lies in or near the periphery of the globe.

The procedure on which we depended primarily was as follows: The ophthalmologist held a small metallic ball of solder fused to the point of an ordinary lead pencil against the center of the anesthetized cornea while films were made in the anteroposterior and lateral projections. We had confidence in this method because of the simplicity and ease both of its application and interpretation.

Of added value were the principles described by Taft and Pirie on the visibility of a weak x-ray beam when the retina is intact. Due to their fluorescence metallic fragments anterior to the retina may be identified and localized to a particular quadrant by the patient himself. Before attempting this procedure, the subject should be placed in a completely darkened room for 20 minutes to increase the retinal acuity. Care should also be taken to secure the complete cooperation of the patient by explanation and a preliminary demonstration on the uninvolved eye. It should be remembered that x-rays are not inverted by the lens as is visible light. Consequently, the actual location of the foreign body is diametrically opposite to that described by the patient.

Retinal tears may be recognized as dark areas in an otherwise homogeneous field. This was observed in several patients. One of these, with direct beam, described a darkened area along the outer lower quadrant of his left eye. The right eye responded normally. This was interpreted as a partial retinal detachment confined to the superior mesial aspect of the involved globe. On physical examination there was light perception only. The vitreous appeared slightly hazy, and a partial retinal detachment was seen with the ophthalmoscope as predicted.

Removal of foreign bodies.—Once the presence of an intraocular foreign body has been established, its character and exact location must be sought before deciding upon removal or nonintervention. Those of inert material, located in such a manner as not to impair visual acuity, or even minute, multiple, foreign bodies, may induce only transient irritation and if left in place impair the visual acuity little if at all.

The best surgical approach depends partly upon the position of the foreign body and partly upon the length of time it has been present. Not infrequently we found as many as 15 to 30 minute

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particles in the cornea and sometimes in each cornea. Such foreign bodies were for the most part powder granules or pieces of unconsumed explosive. They were best removed under the slit lamp, using a Ziegler's knife-needle. Less intense reaction was occasioned if only a few were removed each day rather than attempting a clean sweep at one sitting.

Foreign bodies in the anterior chamber were removed by forceps through a keratome incision. Those in the lens were undisturbed and their later management lay in other hands. One fragment in the posterior chamber was drawn into the anterior chamber by means of the giant magnet and then removed through a keratome incision.

In none of the patients with foreign bodies in the vitreous or coats of the eyeball was it possible to draw the foreign body into the anterior chamber. Some of these foreign objects were undoubtedly nonmagnetic fragments, but others, although later shown to be magnetic, were so attached by inflammatory exudates or partially embedded in the choroid or sclera that the giant magnet was ineffective.

Whenever possible the foreign material was removed by the posterior route. This entailed either an approach through the penetrating wound or by way of a scleral incision through a conjunctival flap at the site of election. If the foreign body was obviously adjacent to the wound of entrance or within 1.5 cm. of it, its removal was attempted through this wound. This approach eliminated additional disturbance of the intraocular structures, and in any event the original wound had to be repaired. The diascleral route for removal was chosen if the giant magnet could thus be brought nearer the fragment. It was found that either approach necessitated a wound which was larger than the greatest diameter of the foreign body, and that the scleral edges should be separated enough to admit at least the tip of the magnet. The sclerotomy incisions and the wounds of entrance were rimmed with diathermy needles to induce choroidoretinal adhesions and thus prevent later retinal detachment.

Most of the extraocular foreign bodies in the orbit which were removed were situated in the superior or posterior orbital tissues. An incision was made through the shaved eyebrow approximately over the site of the fragment. Approach was then made by blunt dissection with a mosquito hemostat and the final attempt at contact carried out with a 2½- or 3-inch 22-gage needle. Such needles provide a more sensitive instrument than the average probe and produce less trauma and distortion of tissue. If contact with the foreign body was not made promptly, the needle was left in place and further roentgenologic studies were made to determine the position of the fragment in relation to the point of the needle.

Another aid consisted in placing a skin clip at the bottom of the exploratory wound, a suture having been tied to the clip and per-

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mitted to extend from the wound. After further films, to determine the relation of the foreign body to the clip, the suture served as a guide to the clip and facilitated its removal when no longer needed.

The extraction of magnetic foreign bodies from the orbit with the giant magnet was only possible when adequate retraction of the exploratory wound could be obtained.

Fragments along the floor of the orbit may be removed in a similar fashion through an incision in the lower lid near the infraorbital rim. Regardless of which approach is made, the lids should be sutured to safeguard the globe before any manipulations are attempted.

Almost all foreign bodies in the cornea, conjunctiva and sclera of the anterior half could be removed before the patients were evacuated from the ship. Five ferrous foreign bodies in the posterior globe with minor injury to the globe were removed. In one other patient we were unable to remove an identified radiopaque substance in this position. In 16 patients with single foreign bodies posterior to the lens we were able to remove the foreign body in 9. Six of these were ferrous. Seven single intraorbital fragments were removed, of which 6 were ferrous and one an unidentified substance. Five single foreign bodies in the orbit were not removed.

INJURIES TO THE BONY ORBIT

Injuries to the bony orbit were noted in 14 patients. Edema or hemorrhage in the orbital tissues was a constant finding. Damage to the globe may vary from minor alterations to posterior perforation or even rupture. Although damage to the bony walls of the orbit is usually regarded as especially serious, 3 patients with destruction of the orbital roof and tearing of the dura and cerebrospinal leak recovered. One of these patients had complete destruction of the external nose and most of the hard and soft palate were missing. The superior wall of the orbit and a portion of the left frontal bone were fragmented and cerebral tissue presented in this wound. The globe had been shattered. While under care aboard ship the patient was conscious, suffered little or no pain, and was afebrile. During his stay he received sulfathiazole by mouth in adequate dosage. The consensus is that the uneventful course of these patients was due to the effectiveness of their sulfonamide therapy.

In three patients, the wound connected the orbit with the ethmoidal cells of the same side, and in one patient with the sphenoidal sinus, without evidences of infection of sinus origin appearing in the orbit. The use of sulfonamide drugs undoubtedly prevented many serious complications formerly regarded as inevitable.

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TABLE 5

ENUCLEATIONS

Case	Lids	Cornea	Iris	Anterior chamber	Lens	Vitreous	Retina	Eyes involved	
								O. D.	O. S.
1428	Lacerated	Lacerated.	Torn	Loss of aqueous.	Dislocated	Loss	?	+	
1444	Edema	Intact	Intact	Shallow	Intact	Hemorrhage. Partial loss.	?		+
1770	do	Lacerated	do	Loss of aqueous.	Opaque	Loss	?	+	
1794	Edema. Puncture wounds.	Foreign bodies 02.	Torn 02	Cloudy. Foreign bodies 02.	Opaque 02.	Hemorrhage.	Detachment O. S.	+	+
2740	Intact	Destroyed	Destroyed.	Loss of aqueous.	Lost	Loss	?		+
2796	do	Hazy	Torn	Contains lens and blood.	Dislocated anterior to iris.	?	?		+
2804	Lacerated	Destroyed.	Destroyed	Loss of aqueous.	Lost	Loss	?	+	
4201	do	do	do	do	do	do	?		+
4557	Edema	do	do	do	Destroyed	do	?	+	
4869	Lacerated	do	Torn	do	Shattered	do	?		+
4887	do	Lacerated.	Lacerated.	do	Fragmented.	do	?	+	
4567	do	do	do	do	do	do	?		+
6493	Edema	do	Torn	do	do	do	?		+
7188	Lacerated	do	do	do	Lost	do			

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TABLE 5

ENUCLEATIONS

Site of entrance	Other wounds	Foreign bodies		V. O. D.	V. O. S.	Days after injury		Retinal response to x-ray	
		Type	Location			Admitted	Operated	O. D.	O. S.
Anterior globe.	Compound fracture of right mandible. Compound fracture left clavicle. Fractured ribs. Fractured phalanges.	Multiple Minute	Cornea, conjunctiva, anterior chamber.	0	20/20	3	5	0	+
Inner canthus.	Shrapnel left forehead, left chest, left leg.	None	None	20/20	0	3	6	+	0
Near inner canthus and below limbus.	Shrapnel wounds right leg and right buttocks.	?	Orbit. Ethmoid cells.	0	20/20	3	6	0	+
Lids and globe 02.	Shrapnel wounds left shoulder, left zygoma, face and left thumb.	Iron and copper	Cornea 02. Both globes.	Light	0	3	9	0	0
Anterior globe.	Compound, comminuted fracture of mandible.	Iron	Left globe and orbit.	20/20	0	10	14	+	0
Outside limbus.	Multiple shrapnel wounds of nose and face. Through and through wound of left cheek.	do	Anterior chamber.	20/20	0	3	7	+	0
Anterior globe and orbit.	Fractures of right orbit, right malar bone, right maxilla, lateral half of right antrum pulverized, right mandible. Lacerations of shoulders.	do	Globe and orbit.	0	20/20	3	4	+	0
Anterior globe.	Multiple shrapnel wounds left shoulder, right leg, left ankle.	do	Globe	20/20	0	8	9	+	0
Anterior globe and orbit.	Multiple shrapnel wounds left shoulder, left forearm, right half of back, lower abdomen, buttocks and left ankle.	Aluminum Iron	Orbit	0	20/20	7	9	0	+
Anterior globe.	Shrapnel wounds of hands, right ilium, left thigh, left gluteal region, left leg.	Steel	do	20/20	0	8	9	+	0
Anterior globe and orbit.	Shrapnel wounds of right forehead, neck, face, both arms, both legs, left thigh. Right leg cyanotic below knee.	Iron	do	0	20/20	8	10	0	+
Do.	Multiple lacerations of right arm and elbow.	Debris	Globe and orbit.	20/20	0	8	8	+	0
Anterior globe.	Bullet wound through orbit, septum and ethmoid sinus.	Not retained		20/20	0	13	15	+	0
	None				20/20	1	1	0	+

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EVISCERATIONS

Case	Lids	Cornea	Iris	Anterior chamber	Lens	Vitreous	Retina	Eyes involved	
								O. D.	O. S.
1495	Lacerated	Lacerated	Torn	Loss of aqueous.	Dislocated	Loss	?		+
1493	do	Intact	Intact	Cloudy	Intact	Opaque. Some loss.	?	+	
1756	do	Lacerated	Torn	Loss of aqueous.	Dislocated	Loss	?	+	
1494	Intact	do	Irregular	Cloudy	Rupture of capsule.	?	?	+	
1429	Lacerated	Opaque	?	?	?	?	?	+	
1433	do	do	?	?	?	Loss	?		+
1432	do	Lacerated	Prolapse	Foreign bodies.	?	?	?		+
3433	do	do	Torn	Loss of aqueous.	Fragmented.	Loss. Hemorrhage.	?		+
5449	do	do	do	do	Opaque	?	?		+
6067	do	Lost	do	do	Fragmented.	Loss	?		+

The manner in which foreign bodies in the orbit were managed depended upon whether the globe was preserved, damaged or destroyed. When the globe was intact, efforts directed toward the removal of the foreign body were confined to those which would interfere neither with the mobility nor vitality of the globe. If the intraorbital foreign body could not be removed without damage to the globe, it was not disturbed. Suturing of the eyelids was employed whenever there was proptosis from edema of the orbital tissues or intraorbital hemorrhage. In addition, if orbital cellulitis was present, drainage tubes were introduced along the superior and inferior bony walls of the orbit through incisions in the upper and lower lids.

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EVISCERATIONS

Site of entrance	Other wounds	Foreign bodies		V. O. D.	V. O. S.	Days after injury		Retinal response to x-ray	
		Type	Location			Admitted	Operated	O. D.	O. S.
Cornea	Left pectoralis major missing. Exposure of right knee joint. Lacerations both shoulders and right leg.	Aluminum	Posterior orbit.	20/20	0	3	5	+	0
Globe above limbus.	Multiple shrapnel wounds of forehead and right knee.	Iron	do	0	20/20	3	5	0	+
Center of anterior globe.	Compound fracture of tibia and fibula. Multiple shrapnel wounds of right trunk, right leg, left buttock.	Not retained		0	20/20	3	5	0	+
Through anterior and posterior globe.	Compound fracture left os calcis. Shrapnel wounds right axilla and both feet.	Brass. Multiple.	Globe and orbit.	0	20/20	3	5	0	+
Center of anterior globe.	Multiple shrapnel wounds of chest.	Iron	do	0	20/20	3	5	0	+
Globe below limbus.	Shrapnel wounds of left upper arm and back.	Aluminum	Orbit	20/20	0	3	5	+	0
Center of anterior globe.	Shrapnel wounds of face and neck.	None found		20/20	0	3	5	+	0
Orbit and globe anteriorly.	Fracture of mesial antral wall. Shrapnel wounds of left shoulder and trunk.	Multiple	Globe and orbit.	20/20	0	4	6	+	0
Anterior globe and orbit.	Multiple shrapnel wounds of head and back.	Iron	Upper, outer quadrant, vitreous.	20/20	0	5	8	+	0
do	Multiple shrapnel wounds of face, nose, hard palate. Multiple fractures of left facial bones extending through mesial and inferior walls of orbit, through ethmoidal cells, frontal and maxillary sinuses on left. Fracture through left frontozygomatic suture with downward displacement of one cm. Cerebrospinal leak.	None found		20/20	0	12	13	+	0

When the globe was injured, but there was some possibility of preserving it, the lids were sutured prior to the attempt at removal of the intraorbital fragment. All manipulations in these cases required the greatest delicacy to prevent further damage to the globe.

Irreparable damage to the globe because of rupture, free escape of vitreous from scleral wounds or multiple lacerations, necessitated the removal of the potentially dangerous ocular tissues. The question of whether evisceration or enucleation is the wiser procedure in war casualties is not always an easy one to decide. Because so many of our patients had obvious infections deep in the orbital tissues we felt it necessary to perform a disproportionately large number of evis-

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cerations. That this was the safer course under the circumstances was borne out by the subsequent course of the patients. Some data concerning the patients subjected to evisceration and enucleation are shown in table 5. It is perhaps well to point out that we were fortunate in being able to accomplish our eviscerations at leisure, with a good instrumentarium and with reasonable assurance that all portions of the uveal tract could be removed.

In three patients with damage to the bony orbit, the globe was so fragmented that considerable search was necessary to assure the detection and removal of all uveal fragments.

TRANSFIXION WOUNDS

Transfixion wounds were the result of rifle or machine gun fire. The amount of damage to the globe varied widely in our patients. In one patient a machine gun bullet had entered the right side of the face, producing a depressed fracture of the malar bone, fracturing the right maxilla, pulverizing the lateral half of the right antrum and fragmenting the globe as it passed through the anterior orbit.

In another patient less extensive damage occurred from a transfixion wound. A machine gun bullet entered the right cheek just below the external canthus and made its exit by way of the left lower lid near the lacrimal sac. There was a compound, comminuted fracture of both nasal bones and of the floor of the left orbit, but visual acuity of the right eye was 20/20. After absorption of blood in the anterior chamber of the left eye, the visual acuity was 20/20 in both eyes.

In two patients transfixion wounds failed to affect the globes. In one a machine gun bullet had entered through the left nasal bone, passing through the right antrum, fracturing the right maxilla and making its exit just below the right zygoma. The roentgenograms showed a streak of metallic dust extending from the left nasal bone through the right antrum to a point just below the right zygoma, and also showed fractures of the right maxilla. There was edema of the right lower lid and conjunctival edema of the right eye. Visual acuity was 20/20 in each eye. The media were clear and the fundi normal. Diplopia was marked at the time of admission because of absence of inferior rectus action on the right side. With subsidence of edema, the diplopia disappeared 5 days later when the inferior rectus action was restored.

In the other patient, a machine gun bullet entered the left malar area, 2.5 cm. below the outer canthus, and the wound of exit was 8 cm. posterior to the lobe of the right ear and level with it. There was left facial paralysis. A few subconjunctival hemorrhages were present in the left eye but the visual acuity was 20/20 in each eye and the media were clear and the fundi normal.

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INJURIES TO HIGHER VISUAL PATHWAYS

Injuries to the higher visual pathways or the visual cortex were rare, but in one patient with a small laceration of the head at the lower level of the lateral sinus, the roentgen examination revealed a small, radiopaque, intracranial foreign body. Physical examination showed a right homonymous hemianopsia and slight blurring of both discs.

The use of local anesthesia differed in no way from the accepted and generally used procedures. When general anesthesia was indicated, intravenous sodium pentothal almost exclusively was employed because it could be administered by nurses or corpsmen under the direct supervision of the surgeon. The drug was satisfactory in every respect and in the 32 patients who received this form of anesthesia there were no complications.

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OXYGEN POISONING

There are three types of situations involving possible oxygen poisoning: (1) At high altitudes, as in flying, where supplemental oxygen is given to counteract the insufficiency of the air. (2) In deep-sea diving, in which toxic pressures of oxygen may be quickly reached. It is the dream of those interested that an understanding of the mechanism of oxygen poisoning will enable man to descend to depths limited by the strength of materials rather than his physiology. (3) In disease, particularly pulmonary and cardiac, producing insufficient saturation of blood hemoglobin, alleviated by oxygen administration. Poisoning may arise here if the safe dose is exceeded.—STADIE, W. C.; RIGGS, B. C.; and HAUGAARD, N.: Oxygen poisoning. Am. J. M. Sc. 207: 84–114, January 1944.

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LIVER FUNCTION TESTS

Hippuric acid liver function tests by the oral method is a measure of the power of the liver to convert benzoic acid to hippuric acid, and is considered to be an index of the "detoxifying" power of the organ.

Briefly, it is carried out by giving orally 6 g. (*sic*) of sodium benzoate in the early morning and collecting for four hours complete hourly specimens of urine. The hourly excretion of hippuric acid is remarkably constant in the normal adult, who will excrete about 3 g. (*sic*) of sodium benzoate (in the form of hippuric acid) in four hours. Three grammes is chosen as the average normal for calculating the output in terms of percentage of normal. Excretion of over 90 percent of this amount is regarded as nonpathological.—GORDON, I.: Infective hepatitis; with special reference to oral hippuric acid test. Brit. M. J. 2: 807–811, December 25, 1943.

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EXPERIENCE WITH BRAIN INJURIES IN THE PACIFIC

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Warfare in the Pacific, particularly the amphibious phase, has produced its share of brain injuries. Experience with a number of these casualties at both advance and distant bases and during transit on board a hospital ship urges a reiteration of the proper method of handling these cases.

Reference is made to Cairns (*1*) and Horrax (*2*) for a review of the governing principles and operative technic in gunshot wounds of the head. Their material is derived from neurosurgical work in England during 1939–41 and considers both initial and late results among 250 cases of cranial war injury encountered in 1917 by Cushing. The most recent lessons of advance base neurosurgery are stated by Miller (*3*) from campaign action in the western desert of North Africa. A brief chapter from the Pacific area is needed to emphasize facts obscured by the unusual conditions of environment, transport, and operating facility characteristic of mobile combat.

These conditions demand rapid evacuation of the wounded after control of hemorrhage and shock, a policy implemented largely by the use of plasma and the air ambulance service. Few cases were seen who appeared to be any worse for the plane journey. If able to be moved at all, individuals with head wounds readily tolerate flight at moderate altitudes. The only exception is those patients with respiratory disturbances of central origin.

In the beachhead stage of amphibious attack, casualties in need of early surgery are evacuated by sea as soon as possible. Some of these are penetrating head wounds. When a periphery of defense has been established, adequate surgical work can be performed on brain wounds with proper equipment and organization *in jungle terrain*. There are many difficulties, the greatest usually being the problem of local transport of wounded. Conditions improve with the military situation until an air ambulance service becomes available and cases can be evacuated regularly to a nearby advance base.

The surgical centers within feasible flying range of the fighting front receive casualties on the average of 48 hours after occurrence. Surgery is limited to obvious indications. Burns and fractures are treated as required. Chest wounds need tamponade and physiologic adjustment of pulmonary difficulty. Wounds of the trunk or extremities receive debridement and removal of metallic fragments only if

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these are readily accessible. Amputations are sometimes necessary and perforating abdominal wounds may demand exploration. In general, however, open treatment, local use of microcrystalline sulfonamide and pressure dressings have produced excellent results and have enabled patients to be transferred to distant base hospitals where definite surgical care can be carried out to the best advantage.

The proved principle of leaving wounds of the trunk or extremities unsutured has fostered a notion that the practice applies with equal optimism to the head. This idea is wholly false and, if followed, guarantees bad results. Superficial lacerations of the face and scalp, when properly cleansed and debrided early, usually heal well and without local chemotherapy because of the rich lymphatic and blood supply. Dependent drainage in deep faciomaxillary wounds with associated damage of bony structure and hemorrhage into sinus or orbital spaces, materially assist in this process. In these cases, loose suture, even mucous membrane to skin, and oral sulfonamide will save tissue and contour and ameliorate plastic revision.

Penetrating wounds of the brain and compound skull injuries deserve special consideration. The optimum time for major surgical repair following injury is 24 to 48 hours. In fortunate instances this period has been stretched to 4 or 5 days. Beyond the third day, however, irreversible infection has most likely become established, despite sulfonamide prophylaxis. A number of such cases were seen, ranging from 7 to 15 days after inception. Sulfanilamide or sulfathiazole had been given orally and crystals were present in the wounds. In a few, the scalp had been debrided and sutured. All showed evidence of intracranial infection.

CASE REPORTS

INFECTED CASES

Case 1.—This patient was struck in the back of the head by a sniper's bullet. He was rendered unconscious for a short time, but on recovery was able to walk to the field dressing station where tetanus toxoid was given and the scalp wound sutured. Sulfanilamide was administered locally and orally. The patient was evacuated by air and when examined at this hospital 9 days after injury was poorly oriented, overtalkative, and restless. He complained of a bursting headache. There was a gutter wound of the head, 5 cm. to the right of the midline, reaching diagonally to a point above the left upper limb of the lambdoidal suture. It involved both the occipital and left parietal bones and exposed a 4-cm. slot-like defect through which protruded an infected cerebral herniation.

The neurologic examination revealed 2-plus nuchal rigidity, 3 to 4 diopters papilledema, right homonymous visual field defect, paraplegia in extension with bilateral Babinski and confirmatory signs. The abdominal reflexes were unequal and there was partial loss of all sensation in both legs below the hips. The vibratory sense was absent below the iliac crests. X-ray examination revealed the cranial defect as described and numerous small bone fragments

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embedded in the left parietal lobe. A pneumatocele was also noted in this region, but was not connected with the adjacent ventricle.

Spinal puncture showed an initial pressure of 600 mm. of water, cell count was 4,000 with 35 percent white blood cells.

The diagnosis included a penetrating gunshot wound of the brain, localized cerebritis (left parietal lobe), meningitis, and thrombosis of the longitudinal sinus.

Treatment: The exposed scalp tissues and cerebral fungus were covered with a rubber-dam and bulky, moist (saline) head dressing. Eight grams of sulfadiazine was administered daily. Periodic vomiting required parenteral fluid administration until the intracranial pressure was reduced to lower levels by frequent lumbar drainage. Barbiturate sedation was given as required. The temperature ranged from 99° to 101° F. When the patient was transferred after 5 days, he was retaining fluids and nourishment, the meningeal signs were less prominent, the headache and restlessness improved, but the neurologic status was unchanged.

Comment.—The unusual neurologic picture developed as a sequel to the infection. Abscess formation was suggested by localizing signs and by the pneumatocele which was probably generated by gas-forming bacteria. The outlook for this patient was poor because of complications arising in a brain wound that had been amenable to primary repair and closure at an earlier stage.

Case 2.—The patient was hit by a sniper's bullet on a raiding expedition. He felt a sharp blow against the right side of his head and immediately became aware that his left leg was totally paralyzed and his left arm practically so. The wound was dressed in the field. Tetanus toxoid was given together with local and oral sulfanilamide. The patient was conscious and rational and all vital signs were normal. There was an oval-shaped scalp wound 3 by 2 cm. in the right upper coronal region, 4 cm. from the midline with an extruding cerebral fungus.

Neurologic examination on the 7th day after injury revealed no meningeal signs, but a left facial paresis was present, more apparent on voluntary than involuntary innervation, complete flaccid paralysis of the left lower extremity and upper limb to the shoulder where movements were weak; pyramidal reflex signs were present (Babinski, Rossolimo, Hoffmann, Leri, etc.). There was some loss of position and discriminatory sense in the lower arm, hand, and leg, but other forms of sensation were well preserved. Skull x-ray showed implanted bone debris in the right frontal lobe beneath the coronal defect.

The following diagnosis was made: Gunshot wound of the brain with penetration by bone fragments; localized right pre-Rolandic cerebritis with left hemiplegia.

Treatment: Exploration of the wound was done under local anesthesia and several bone fragments from the upper pre-Rolandic area were removed. The local cortex was sloughing and invaded by dense, granulating scar tissue. The wound was left open and draining. The patient was maintained on adequate dosage of sulfathiazole. There was an occasional temperature rise to 101° F. Except for returning tonus in the musculature of the paralyzed limbs, no change was noted before transfer 2 weeks after admission.

Comment.—The prognosis here is probably not as poor as for the previous patient. A brain abscess may have developed, and the ultimate prediction indicates a permanent hemiplegia with the subsequent

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possibility of Jacksonian epilepsy. Infection in a lesion of the motor cortex engenders fibrocytic invasion and increases the likelihood of eventual convulsive disorder. Clean debridement and closure of this wound in addition to saving viable neurons, would at least have mitigated the epileptic trend by limiting scar tissue mostly to gliosis.

OPERATIVE CASES

Case 3.—The patient was 20 feet away from a 100-pound bomb explosion and received penetrating fragment wounds of head and left knee. There was considerable blood lost from the knee injury. He was examined 1 hour after injury and found to be comatose and in shock. The temperature was 97° F., pulse 110, blood pressure 86/50. One-half grain of morphine, 750 cc. of plasma, and ½ cc. of tetanus toxoid were given. The patient was responding to shock therapy but not oriented 20 hours later. There was a ragged laceration medial to the left patellar tendon, a wound 1 by 0.5 cm. over the left frontal sinus and ecchymosis of orbit.

Neurologic examination disclosed dilatation of the left pupil and bilateral Babinski signs. Skull x-ray showed an anterior vault defect involving both walls of the left frontal sinus with bone particles embedded in the frontal lobe and a metallic fragment lodged near the occiptal pole.

Under pentothal and local anesthesia 36 hours after injury a debridement of scalp, skull and missile track to a depth of 4 to 5 cm. was accomplished. The frontal sinus was explored to its base. Blood clots, pulped brain and several bone fragments were removed. The procedure was compromised because of suction failure. A ⅜-inch rubber tube was inserted to the depth of the exploration track and sutured to the galea. The scalp incision was closed as far as the dural laceration. The wound below the left knee was simultaneously debrided by another surgical team and a large metallic fragment was removed from the head of the tibia. A transfusion of 1,000 cc. of blood was given during operation. Five grams of sodium sulfadiazine was administered intravenously 8 hours before and 12 hours after surgery.

On the second postoperative day the erythrocyte count was 2.8 million and the hemoglobin 60 percent. A 500-cc. transfusion of whole blood was given. The patient was conscious, rational, and taking fluids and nourishment orally. He had an intermittent fever to 102° F. There was drainage of sanguineous fluid and necrotic brain substance. The leg wound became infected and was subsequently opened and microcrystalline sulfathiazole applied. Repeat skull x-ray showed a single retained bone fragment which was removed on the seventh postoperative day and the rubber tube changed. Sulfadiazine 6 gm. was administered daily.

The leg wound was clean and the general condition permitted the patient's evacuation to a hospital transport 10 days later.

Case 4.—The patient was struck in the right parietal region by a fragment from the explosion of a 100-pound bomb 15 feet away. He was examined 1 hour later and received ½ grain of morphine. There was a punctate wound of the scalp 1 by ½ cm. over the right parietal region. He was comatose but not in shock. The reflexes were uniformly sluggish. No focal signs were present except bilateral Babinski's. Tetanus toxoid and 500 cc. of plasma were given. The next day he was responding but restless and disoriented.

Operation was performed 52 hours after injury under pentothal and local anesthesia. The scalp, skull, and wound track were debrided. Pulped brain, clots and bone fragments were removed by suction. The dura was repaired with

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galeal graft and the cruciate incision of the scalp closed. A 500-cc. transfusion of blood was given during the procedure. Five grams of sodium sulfadiazine and intravenous fluid was administered before and after operation. Five grams of sodium sulfadiazine was repeated at 24-hour intervals and parenteral fluid given until the patient was able to take 6 gm. orally on the fourth postoperative day.

Mental confusion, prolonged amnesia, and right homonymous visual field defect remained but the wound was well healed and the temperature normal when the patient was transferred to another hospital on the tenth day.

Comment.—Both these patients exhibited prolonged unconsciousness and anterograde amnesia, indicating a high degree of energy dispersal by the missiles as they penetrated the brain substance. The cerebral acceleration delivered by the blow of a blunt object produces a similar general effect on the brain, although the kinetic properties are different. Velocity, size, and type of tissue entered are the chief factors of injury in penetrating metallic fragment wounds. In cases 1 and 2, there was no acceleration and the local energy dispersal generated by the slow-moving bone fragments was insufficient to produce unconsciousness and its sequelae. Greater initial tissue destruction occurred in cases 3 and 4 and their favorable outcome may be ascribed to control of infection, in which surgical intervention at the optimum time proved to be more decisive than chemotherapy. The converse of this proposition applies logically to cases 1 and 2.

There was no evidence of blast injury in cases 3 and 4, partly because the detonation of a relatively small charge happened to have adequate distance and space in which to vitiate its lethal force; and partly because the patient in case 3 was crouched on the ground at the instant of impact and in case 4 was running away from the anticipated explosion. Neither was wearing a helmet when hit.

NONOPERATIVE CASES

Case 5.—The patient was injured by a 500-pound bomb hit on the flight deck of an aircraft carrier. He was standing with his back toward the explosion with his trunk shielded by the structures surrounding his battle station. However, he was close enough to sustain flash burns of the neck. The patient was unconscious for 48 hours and was treated for shock and exposure during sea rescue. He was examined on the fifth day, at which time he complained of a headache. The temperature was 100° F., pulse, respiration and blood pressure were normal.

The following neurologic signs were revealed. There was nuchal rigidity and a quadriplegia, affecting the legs more than arms, completely sparing the sensory responses. Spinal fluid pressure was 600 mm. of water, cell count was 15,000 with 90 percent red blood count. A severe compound fracture of the left hand was treated by the closed plaster technic. Skull x-ray showed multiple tiny metallic splinters scattered throughout the brain. External perforations were found on the shaved scalp.

The diagnosis of central nervous system blast injury and focal interpeduncular lesion was made.

Treatment: Frequent lumbar drainages were done to reduce pressure and remove the red blood cells. Oral sulfadiazine was administered. The headache, motor weakness and pyramidal signs improved in the arms after the first week.

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The patient was evacuated by hospital transport 2 weeks later with normal vital signs and the paraplegia unchanged.

Case 6.—This patient was examined 12 days after being shot through the head, at which time his temperature was 101° F., pulse and blood pressure were normal. There was a punctate entrance wound below the left malar eminence and a ragged exit wound in the right external auricular canal, draining foul pus.

The following neurologic signs were present: Head turned involuntarily to the left, coarse, horizontal nystagmoid movements on right lateral gaze; paralysis of conjugate gaze to left; right eighth nerve deafness; left hemiplegia with indeterminate sensory involvement. Spinal fluid pressure was normal; 40 white blood cells were present. X-ray showed fracture and clouding of left antrum and metallic particles distributed along bullet track. Attempt to demonstrate the latter with iodized oil was unsuccessful.

Diagnosis: Gunshot wound of head with focal point lesion.

Treatment: Sulfadiazine 6 gm. was administered daily. Frequent irrigations of the draining ear wound with sulfa-saline. The patient was transferred after 4 days with a low-grade fever and his neurologic status unchanged.

Case 7.—This patient was shot through the head but did not lose consciousness. One-half grain of morphine was administered. He was examined 2 hours later. The vital signs were found to be normal. A punctate entrance wound was present above the right zygoma midway between the ear and orbit. The exit was through the left orbit, destroying the eyeball and leaving a 2-cm. laceration below and lateral to the lower lid. Bilateral Babinski; spinal fluid findings were normal. X-ray showed destruction of the lesser wing of the right sphenoid, with a hole through the medial wall of the orbit below, and clouding of the left orbit and antrum.

Treatment: Microcrystalline sulfathiazole was dusted on the wounds and gauze pads bandaged over both eyes. A left enucleation was performed on the third day and the right eye kept at rest under atropine. The patient made an uneventful recovery with resolution of neurologic signs and was evacuated in good condition.

Case 8.—The patient was 30 feet distant from an aerial bomb explosion. He was knocked unconscious for 10 minutes. When the patient was examined 40 minutes later he was oriented and rational, but complained of numbness and tingling in his left forearm and hand. There was a 2-cm. curved laceration of the scalp, exposing the periosteum midway between the right ear and the crown.

The following neurologic signs were present: Weakness of the left arm, increasing from the elbow to the fingers with disturbance of protopathic sense and astereognosis; left Babinski. Skull x-ray was negative and the spinal puncture findings normal.

The scalp wound was cleansed and approximated. Left facial paresis was noted on the third day and sensory loss increased. Preparation was made for right-sided exploratory trephine on the fifth day, but abandoned because of marked improvement during the next 24 hours. Neurostatus was normal by the eighth day and the patient was discharged well 3 days later.

Case 9.—The patient fell 18 feet, striking his head on the deck of a ship. He was examined 2 hours later at which time the pulse and blood pressure were within normal limits. There was a bilateral subconjunctival hemorrhage and bleeding from the left ear. The patient was comatose with absent corneals and generally diminished reflexes. Slow, searching nystagmus and sluggish pupillary light reaction were present. The patient was unconscious 6 hours. Spinal fluid pressure was 300; 90,000 red blood cells. X-ray revealed an eggshell type of fracture involving the upper vault and crossing the midline.

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Treatment: Rest with head elevated 12 inches. Gentle daily cleansing of left auricular canal with peroxide solution and cotton wipes. Lumbar puncture was repeated at 12 to 24 hour intervals for 6 days for reduction of pressure and removal of red blood cells. Physiologic fluid 2,000 cc. was administered daily by vein until the sixth day when normal oral intake was possible. Left ear was dry and orbital ecchymosis was subsiding after 2 weeks. The patient was ambulatory at 5 weeks and discharged asymptomatic for further convalescence shortly thereafter.

Comment.—Case 5 illustrates the type of brain injury caused by penetration of minute metallic particles from a heavy bomb explosion at close range. Sufficient heat is generated by the velocity of the fragments to sterilize their entrance tracks and infection is only superficial. The victim in this instance would probably have been killed by the blast if his body had not been fortuitously protected.

Three other cases caused by energy dispersal from passage of high speed missiles through adjacent tissues ("near-misses") exemplified central neurologic injury without direct penetration of the brain. The lesion is usually reparable, producing transient symptoms and signs, but irreversible damage may occur. The final protocol represents the more serious type of closed head trauma caused by blunt impact.

Major and minor variations of these cases comprise the largest category of head injury in general that may be anticipated wherever combat or advance base activities are in progress. Although observations of ultimate convalescence are lacking, the immediate results appeared to be excellent.

SUMMARY

In penetrating brain wounds and compound skull injuries, sulfonamide therapy can be expected to modify but not to prevent intracranial infection. Surgical repair at the optimum time is the mandatory treatment, to which chemotherapy is a valuable adjunct.

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EXPERIENCE IN THE TREATMENT OF BURNS

FROM THE SOUTH PACIFIC AREA

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A large number of casualties with burns from sea, land, and air engagements in the South Pacific area have been received at this Naval hospital during the year from August 1942 to August 1943. This study is based on a series of 200 consecutive cases and includes both a discussion of the methods used at this hospital and observations made on the results of treatment given elsewhere before admission.

The great majority of these patients had received excellent care and arrived in good general condition. In evaluating the success of the early treatment it should be borne in mind that many of them had been treated under combat conditions without the advantages of a well equipped hospital. This initial treatment and the prompt and liberal use of plasma, had obviously resulted in the saving of many lives.

There were 67 patients with third-degree burns, 51 of which were extensive enough to require skin-grafting. The other 16 had small third-degree areas in combination with larger second-degree areas. The remainder of the 200 cases were classified as second degree. Flash burns from explosions accounted for 80 of these and were almost without exception burns of first- and second-degree occurring on the exposed parts of the body. Gasoline caused 54 burns which were sustained aboard aircraft carriers, in airplanes and in attempting to start fires in the damp tropics with gasoline. There were 18 burns resulting from a combination of flash and flame. There were 16 burns resulting from burning oil; 10 powder burns; and 4 electric burns. The remaining few were produced by steam, hot metal, boiling liquids, and by friction from ropes.

The patients were received here on the average of 2 to 2½ weeks after injury, so that the critical stages of shock and toxemia had passed. Attention was therefore concentrated on the definitive local treatment of the burned areas. One of our main problems was the management of infection.

INCIDENCE OF INFECTION

The incidence of infection in this group was high. Almost one-third of the cases had been infected or were grossly infected at the time

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of admission. The major portion had been treated primarily with (1) tannic acid jelly; (2) tannic acid jelly in combination with sulfanilamide or sulfathiazole powder locally; or (3) with sulfonamides alone, in ointment, powder, liquid emulsion, or wax spray, but chiefly in the form of sulfathiazole ointment. This latter group is designated in table 1 under the heading of sulfonamides.

A few were treated primarily with gentian violet, triple dye, tannic acid spray in combination with silver nitrate, picric acid, oleomargarine, and lard. These numbers are too small to evaluate the results and are designated in the table under the heading of miscellaneous. It is enlightening to note the incidence of infection in relation to the various primary treatments, as shown in table 1.

TABLE 1.—*Incidence of infection in 200 cases*

Primary treatment	Number of cases treated	Number of cases infected
		Per-cent
Tannic acid jelly	100	44 or 44
Tannic acid jelly in combination with sulfonamides	30	6 or 20
Sulfonamides	55	8 or 15
Miscellaneous	15	5 or 33
Total	200	63 or 32

The 44-percent incidence of infection in those cases treated with tannic acid jelly alone was reduced by more than half (20 percent) when the jelly was used in combination with sulfonamides; whereas only 15 percent of the patients treated with sulfonamide preparations alone became infected. The incidence of infection, following all methods of treatment, undoubtedly could have been reduced if time and facilities had been available for cleansing of the wounds and the use of an aseptic technic.

The incidence of infection definitely increased with the depth of the burn. Seventy-one percent of the third-degree burns, extensive enough to require grafting, were infected in contrast to 27 cases or 18-percent infection for the second-degree group. Table 2 shows the primary treatments of the third-degree burns in relation to the percentage of infection.

TABLE 2.—*Incidence of infection in third-degree burns*

Primary treatment	Number of cases treated	Number of cases infected
		Per-cent
Tannic acid jelly	32	28 or 88
Tannic acid jelly in combination with sulfonamides	4	2 or 50
Sulfonamides	12	3 or 25
Gentian violet	2	2 or 100
Triple dye	1	1 or 100
Total	51	36 or 71

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The significant finding of 88-percent infection occurring in the third-degree burns treated with tannic acid shows the inadvisability of treating serious burns under combat conditions with any tannic acid preparation.

Of the 73 men who had been in the sea for any length of time, 22 percent developed infections of their burns in contrast to 37 percent infection in those not exposed to sea water.

Not a sufficient number of patients had adequate sulfonamide therapy by mouth to enable us to form any conclusions as to the efficacy of this treatment.

METHODS OF TREATMENT

From a study of these patients we have been able to standardize a definitive treatment of extensive infected burns, our aim being to relieve pain, shorten convalescence, and prevent scarring and contractures.

General treatment.—In fresh burns, the primary consideration is the general treatment of the patient, but the general condition of the patient with older burns should also receive careful consideration. Those patients suffering from burns 2 to 3 weeks old were not given sulfonamides by mouth unless they were febrile and showed a systemic reaction. Fever above 100° F. was rare except in those patients who also had malaria. All patients were given ferrous sulfate grains 3, three times daily after meals and a blood transfusion if the hemoglobin was below 60 percent. None of them were grafted until the hemoglobin was 70 percent or more. They were given multiple vitamin capsules and also ascorbic acid 50 mg., three times daily. The diet was high in protein, salt, and sulfur. The fluid intake was kept up to 3,000 cc. daily, supplemented by intravenous fluids if necessary. The urinary output was checked carefully. Blood protein, chloride and nitrogen determinations were made as indicated.

Sedatives are given as necessary but care must be taken to avoid morphine addiction. The bolstering of morale in these patients is very important as there are few casualties who have as much prolonged suffering as the severely burned patient.

When burns involve joint surfaces, it is of vital importance to take steps to prevent contractures. This is best accomplished by daily warm soaks; regular, supervised, active and passive exercises; and temporary splints when necessary. The latter are useful in burns of the wrists and fingers. A fracture bed is kept in the burn ward and overhead suspension is instituted at the first sign of a flexion contracture of the extremities.

Local treatment of infected burns.—After trying various methods it has been concluded that the most efficient treatment of infected second-

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and third-degree burns consists in the local application of sulfanilamide powder and continuous moist saline dressings. It has been learned from experience that vaseline and ointments have no place in the treatment of infected burns. Constant adequate drainage is just as important in these cases as in any other infected wound. Vaseline and ointments tend to seal in the pus and prevent drainage. The equipment is not available at this hospital to administer saline baths, and although time consuming, they undoubtedly would be useful in many of the cases.

If infection is present under an eschar such as that produced by tannic acid or gentian violet, windows are made in the eschar. The area is kept constantly moist with saline and is soaked daily in an aqueous chlorine antiseptic solution. These measures soften the eschar and facilitate its removal.

When a patient with an infected burn is admitted, all of the necrotic skin and sloughing tissue is excised. This may be accomplished with practically no pain if morphine has been administered. No anesthesia is required. Soaks in azochloramid solution (1:10,000) are very helpful in removing slough and pus. Unless the products of proteolysis are removed, the sulfonamides have very little local effect. The sulfonamides used locally in combination with the chlorine antiseptics are more efficient in the treatment of infections than when used alone. The first step, then, is to perform a gradual debridement aided by an aqueous chlorine antiseptic soak.

The areas are then frosted each day with either sulfanilamide or sulfathiazole powder applied with an insufflator. No conclusions have been reached as to which is superior and the two are frequently interchanged depending upon the progress of the case. Some of the staphylococcic infections seem to clear up more rapidly with the use of sulfathiazole but sufficient cultural studies have not been made to form any definite opinion. The sulfanilamide is more readily absorbed, as the sulfathiazole powder has a tendency to cake.

Too much powder may cause edematous granulations. An excess of 10 gm. of the powder has been used locally over extensive denuded areas and no deleterious effects have been observed except for cyanosis in one case. The danger of over-absorption of sulfonamides which is always a possibility in a fresh burn, does not exist to such an extent when the powder is applied to the granulating surface of an old burn. If the urinary output falls below 1,000 cc., blood sulfonamide level determinations, blood counts, and urinalyses should be made and if necessary the use of the drug should be discontinued. There have been only two cases on the burn service that have developed a sensitivity to the local application of sulfonamides as demonstrated by the development of a rash.

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Following the daily application of sulfonamide powder, the areas are covered with strips of fine mesh gauze and moistened with warm sterile normal saline. The use of fine mesh gauze, such as an ordinary roller bandage, is an extremely important point. It does not become so enmeshed in granulation tissue and therefore is much more readily removed. Recently Callahan's suggestion of applying autoclaved absorbent cleansing tissues directly to the second- and third-degree areas has been followed. This material is proving itself to be superior to fine mesh gauze in every respect. The paper tissue provides adequate absorption and drainage and may be removed painlessly and with less damage to tissues. An atomizer with sterile normal saline may be used very effectively in loosening adherent dressings and is also very useful in irrigating surface wounds.

A burn pad is then applied which has been found very useful in keeping the areas constantly moist with a minimum of effort and trauma. The burn pad measures 24 by 14 inches and consists of several layers of ordinary gauze, a layer of cellucotton, and a layer of wax paper. The three materials are fastened together by several stitches. The pads can be autoclaved and are of such size that they may be placed over the back, abdomen, or wrapped around an extremity. They are secured by several ties of bandage. They can be readily opened and the inner gauze and cellucotton moistened with saline without removing the pad. If the burn pads are saturated every 4 hours, day and night, the wounds may be kept constantly moist without contamination and with a minimum of effort.

They eliminate the tedious application of the ordinary sterile dressings with a roller bandage, reduce the number of painful dressings, and greatly lessen the time required for dressing infected burns. They retain heat as well as moisture and hence promote drainage. There is sufficient padding to afford comfort. The pads represent a saving in time, materials, and nursing care in comparison to the usual application of fresh wet dressings every few hours. They may be discarded in from 24 to 48 hours and fresh ones applied.

A common infection of burns in our experience is that produced by B. pyocyaneus as evidenced by the bright green drainage and characteristic musty odor. This may readily be controlled by applying one-half-percent acetic acid solution twice daily in addition to the sulfonamides and saline. Our experience has confirmed Matthews' observation that sulfathiazole is more effective than sulfanilamide in controlling B. pyocyaneus infection, and its use in conjunction with acetic acid has been helpful.

Once the infection is controlled, the second-degree burns heal rapidly and the third-degree burns are ready to be prepared for grafting. Skin-grafting should be done as early as possible in order to prevent suffering, scarring, and contractures.

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Treatment of second-degree burns after infection subsides.—The outline of this treatment is as follows:

1. Frost with sulfanilamide.
2. Apply cod liver oil and sulfathiazole ointment (10 percent of each in a lanolin and petrolatum base).
3. Place fine mesh gauze or preferably absorbent tissue over the involved area.
4. Pad well with ordinary gauze.
5. Apply elastic pressure bandage.
6. Dress infrequently, not oftener than every 4 days unless there is evidence of a recurrence of the infection.

The same method is followed when there are small third-degree areas not extensive enough to require grafting. It should be emphasized that ointments are *not* recommended in the treatment of *infected* second-degree burns.

Preparation of third-degree burns for skin-grafting.—When the third-degree areas appear clean and when there is a minimum of suppuration, these areas are ready to be prepared for grafting. This final preparation requires 48 hours of treatment conducted as follows:

1. Frost with sulfanilamide daily.
2. Apply strips of fine mesh gauze cut from a roller bandage which has been saturated with a 1 : 500 solution of azochloramid in triacetin (glyceryl triacetate).
3. Cover with a thick layer of gauze dressings.
4. Pour warm saline over the gauze.
5. Apply an elastic pressure bandage.
6. In the evening, remove the elastic bandage and reapply, after again saturating the gauze dressings with warm saline.
7. Keep the extremity elevated.

With this method, a healthy bed for the graft is obtained with red, firm, flat granulations. The pressure dressings definitely eliminate edematous exuberant granulations. It is infrequent that the granulations treated in this manner have had to be excised before grafting. The results have been as good as when they were excised down to the so-called yellow base.

Technic of skin-grafting (split thickness).—The Padgett dermatome has been extremely useful and satisfactory in every respect when it has been necessary to graft extensive areas. With this instrument it has been possible to graft over 160 square inches of skin at one time. The thickness of the graft has ordinarily been cut at 0.015 inch. The back, abdomen, or thighs have been used for donor sites depending on which is convenient and uninvolved by burns. Four drums of skin (32 square inches to a drum) can very easily be taken from the back alone. The following procedures have given the best results:

1. Donor area prepared with tincture of merthiolate, followed by alcohol, and then ether.
2. Area to be grafted prepared with soap, and sterile water, and thoroughly flushed with normal saline.

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3. After cutting the grafts, they are removed from the drum directly onto a sheet of cellophane by means of hemostats and covered with saline sponges. The cellophane keeps the graft from curling up on itself and renders it easier to handle.

4. Granulations excised down to the yellowish base only if they are pale and edematous. Oozing controlled by pressure with hot saline sponges.

5. Area to be grafted is frosted *lightly* with sulfanilamide.

6. Graft transplanted by sliding it off the sheet of cellophane.

7. Grafts sutured in place with black cotton thread, perforated to allow escape of serum, and dusted with sulfanilamide.

8. Graft dressed with layer of fine mesh gauze, then layer of gauze pads, all soaked in warm normal saline. Catheters for irrigation are laid over this layer and then a generous amount of cotton waste is applied. The dressing is wrapped snugly with an elastic bandage.

9. A splint is applied if the graft is over or near a joint.

10. Donor areas dressed with sulfanilamide, vaseline gauze and pressure bandage.

11. Any skin not grafted is placed in a jar of normal saline in the refrigerator for future use in case an incomplete "take" is obtained.

Postoperative treatment of skin grafts.—This consists of immobilization, pressure, elevation, and wet dressings. The postoperative treatment is as follows:

1. Catheters are irrigated with a saturated solution of sulfanilamide in normal saline every 4 hours, day and night. If the solution is heated, the solubility of the sulfanilamide may be increased from 0.85 percent to 3 percent.

2. Catheters are injected once daily with several ounces of ½-percent acetic acid solution to prevent B. pyocyaneus infection.

3. Patient is given sulfadiazine, grains 15, every 4 hours for 5 or 6 days if the grafts are extensive or infection is feared.

4. First dressing of grafted area is done 8 days later, when the sutures are removed, blebs evacuated, and edges are trimmed. The area is then sprinkled with sulfanilamide powder, dressed with fine mesh gauze saturated with azochloramid in triacetin. Gauze pads moistened with saline are next applied and are secured with elastic bandages.

5. When the wound is perfectly clean and no more trimming is necessary, it is covered with sulfathiazole ointment and a pressure dressing is applied.

6. Pressure dressings are maintained for at least 3 weeks from the time of the graft. All splints are removed and active motion of joints is encouraged after 1 week.

7. The dressing of the donor area is not disturbed for 12 to 14 days by which time it is usually healed.

RESULTS

There has been one death in this series of 200 cases. This patient died of a staphylococcic septicemia 18 days after sustaining extensive second- and third-degree burns of the face and upper extremities which had subsequently become infected.

In response to this therapy, the infection of the second-degree burns was usually controlled in a week or less, and the third-degree burns were clean in an average of 2 weeks after admission. Allowing for

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the period before admission, this made it possible to graft the patient in from 4 to 6 weeks after injury.

At this hospital, 33 of the 51 patients with extensive third-degree burns have been grafted, 29 with split-thickness grafts and 4 with pinch grafts. In each of 29 cases, from 75 percent to 100 percent of the grafts resulted in good takes. In 4 cases there was less than a 50 percent "take". There were no failures, and no less than an 80 percent "take" since using the preoperative preparation, operative technic, and postoperative care described. The split-thickness grafts are superior to the pinch grafts for completely covering a denuded area.

Small areas in which the graft did not take have been grafted successfully with skin which has been refrigerated for as long as 2 weeks after removal.

Although there were several patients with third-degree burns of the hand whose fingers were still stiff at the time of their transfer from this hospital, there have been no contractures of any consequence during the time that the patients were under observation.

DISCUSSION

Far too much stress has been laid on the local treatment of burns, whereas the general treatment is the important means of saving the patient's life. Plasma is the ideal replacement therapy for burns, and, with its use, coagulants such as tannic acid are not necessary to prevent the local loss of tissue fluids. Tannic acid increases the incidence of infection under combat conditions, greatly prolonging convalescence, suffering, and disability, with more epithelial loss and resultant scarring.

It would seem that the primary consideration in the local treatment of burns would be the prevention of pain and infection. It is felt that this can best be accomplished by adhering to established surgical principles just as is done in the treatment of wounds. Burns are open wounds and are subjected to rules governing open wounds. They are as follows:

1. Prevent contamination by handling, by exposure to the air, or from the nose and mouth.
2. Gently cleanse the burn mechanically with soap, water, and sterile instruments; apply sulfonamides and a sterile dressing.
3. Apply pressure.
4. Splint the part.
5. Give the patient sulfonamides by mouth.

Applying an eschar-forming substance to a burn which has become contaminated is the equivalent of suturing a badly contaminated wound; and judging from this study, the results are the same.

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On fresh burns of the face, either sulfathiazole or sulfadiazine in a water-soluble base has been used without dressings. This treatment has resulted in a minimum of scarring. Pressure dressings, best applied by means of elastic bandages, have been used for burns of the trunks and extremities. They are extremely valuable at any stage of a burn except when suppuration is present. As Blair pointed out, they limit the loss of tissue fluids, eliminate dead spaces, help prevent edema by supporting the tissues, and alleviate pain. All of these factors promote healing. One of the greatest detriments to the healing of burns is frequent dressings with their attendant trauma and sacrifice of new epithelial tissue. The elimination of this trauma by using absorbent cleansing tissues has proved very satisfactory.

After the Cocoanut Grove disaster in Boston, in November 1942, the general use of boric ointment for all burns was advocated. It seems possible that the good results obtained there could be attributed to the excellent general treatment, aseptic care, the use of penicillin, and oral sulfonamides rather than to the local use of boric ointment. Studies here indicate that the local use of sulfonamides aboard ship or in the jungle is of definite value in reducing infection.

SUMMARY

Experiences in the treatment of 200 burns received in the South Pacific area are summarized.

1. The incidence of infection was lowest in burns treated with non-eschar-forming sulfonamide preparations.
2. The incidence of infection was highest in burns treated with tannic acid and other eschar-forming agents.
3. The principles of the treatment of a burn should be identical to those of treating a wound.
4. A method of clearing up infection in burned areas is presented.
5. The preparation of burned areas for grafting, the technic of skin-grafting, and the postoperative care of grafts is outlined.

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BACTERIA INFECTING WOUNDS

Bacteria infecting wounds in the hospital were, in order of frequency, staphylococci, *Proteus*, *Staphylococcus pyogenes*, *B. pyocyaneus*, *B. coli*, nonhemolytic streptococcus, hemolytic streptococcus, *Clostridium welchii*, and anaerobic streptococcus.

Of 38 wounds treated in closed plaster, 34 became infected.—De Waal, H. L.: Wound infection; preliminary note on combined clinical and bacteriological investigation of 708 wounds. Edinburgh M. J. 50: 585, October 1943.

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BURN TREATMENT AT SEA

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The frequent occurrence of burns incidental to naval action has projected treatment to a role of prominence in medical literature. The divergence of opinion is great and the subject controversial. This brief discussion touches only upon the most practical and useful points of therapy observed personally during the past 15 months.

There is no "ideal" treatment of burns, but some forms of treatment are admittedly better than others. The technic used aboard this ship in treating some several hundred cases and the various aspects of its practical application are described.

Any treatment which calls for special apparatus, formula, or technic of application is, automatically, unsuitable for use at sea. Any treatment that prolongs the convalescent period is undesirable. Any treatment which presents a colored, eschar-covered caricature of a human being is a danger to the morale of the ship's crew, who form unconscious fears of burns after witnessing the unsightly and horrible scenes of a ward filled with a hundred or more burn cases.

The desirable treatment of burns at sea must meet the following requirements, and unless it does meet them, it should not be used or advocated.

1. It should be soothing, efficacious, and reasonably certain to produce good results functionally and cosmetically.
2. It should be simple, direct, and require a minimum of material.
3. It must be simple in technic, so that unskilled help can be utilized.
4. It must combine the advantage of being suitable as a first-aid treatment with that of being a standard therapeutic course.

The treatment which this ship employs meets all the requirements cited, in that it is simple, direct, and efficacious. It is understood that only the *local treatment* is described and all points emphasized in this discussion are taken from actual experience.

All burns, regardless of extent, degree, and condition, were treated alike. Two cleansing agents were used exclusively, namely, soapy water in begrimed cases, white gasoline followed by soap and water in oil-covered cases. Both were used generously and copiously. Morphine was given freely at this stage.

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Two types of cases were received aboard this ship—acute or relatively fresh burns, and burns treated with tannic acid or triple dye and having extensive eschar formations. In every case the dye and tannic-acid treated cases were infected.

The patients having eschars were loosely bandaged and kept under continuous soaks of bicarbonate of soda solution until the eschars were softened and could be removed. This seldom required longer than 24-hours' soaking. The burned area was then cleansed with soap and water.

As soon as the burned area was cleansed it was covered with a thin frosting of either sulfanilamide or sulfathiazole crystals or powder applied with powder blowers. The wound was then covered with close-meshed vaseline-impregnated gauze applied in strips longitudinally, usually two layers thick. When the number of patients to be treated was small and time not a factor, the "pressure type" dressing was applied. Care must be exercised that the vaseline gauze is applied very closely, without wrinkles.

In case of hand burns, each finger was dressed separately. A man burned in action, who is deprived of the use of his hands is a serious morale problem. With separately dressed fingers and some use of the hands the patients help feed themselves, require minimum help with personal toilet and what is most important in their estimation, quickly learn to handle a cigarette. These things may be viewed as minor points, but actually they transform a depressed, melancholy patient into quite a different and more hopeful human being. Burns of the hands exposing tendons are among the most disabling of injuries, yet with this treatment and dressing, patients were able to handle themselves at chow and with smokes in less than 10 days.

When applied properly the dressings were undisturbed, even in tropic zones, and the burn area was seldom redressed under 5 days, regardless of odor.

The results were uniformly good. In most cases litter patients walked off the ship on arrival in home port, and no infected cases were landed.

Burn casualties were in almost all instances received in combat. The subjects were undernourished, jumpy, tense, and depressed.

Immediate attention was given all patients and morphine freely used at this stage. As soon as possible they were cleansed, dressed, and fed every 4 hours on a high protein, vitamin reinforced diet. Once dressed, they were encouraged to try to use feet and hands, and deck privilege was given as soon as possible. Morphine was withdrawn entirely within 48 hours of the first dressing.

Powder blowers were homemade. Vaseline gauze was prepared, 1,000 yards at a time, by utilizing bread molds from the galley as ster-

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ilizing containers. Pressure dressings utilized cellucotton, sanitary napkins, battle-dressings, and available cotton waste from the engine room.

SUGGESTIONS

1. Use of instrument trays for large squares of sterilized vaseline-impregnated, close-mesh gauze.
2. One thousand yards of gauze strips, three inches wide.
3. Lectures and demonstrations to corpsmen on treatment and technic of burn management.
4. Powder, crystals, and blowers available at all times.

This treatment was first employed after a naval engagement, when in an hour's time this ship received some 200 burn cases of all kinds for transfer to the continental ports. After 18 days at sea, 110 were discharged to duty, *all* walked ashore, and no deaths resulted en route.

The transfer was unexpected, and the crew unprepared, yet in 12 hours all the patients were cleaned, dressed, fed, and treated. No other form of burn treatment has been used since that time, and no great departure from the uniformity of good results has been observed.

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SIGNIFICANCE OF THE CARDIAC INDEX

Clinical experience has shown that patients with a cardiac index between 33 and 80 percent are fair surgical risks, between 80 and 100 percent and between 25 and 33 percent they are doubtful and poor operative risks, while above 100 and below 25 percent no surgical procedure is safe. Miles said that opening a whitlow in such a patient is likely to prove fatal. This cardiac index has proved of assistance in the selection of patients for operation, and also after operations, when the blood pressure has been measured and serious disturbances found. It indicates the need for measures to improve the tone and fill the cardiovascular system—necessities that might otherwise be overshadowed by the problem of surgical diagnosis and the operation. Clinical improvement almost invariably follows these remedies, especially in elderly people, in whom the blood pressure is often around 140/70, giving a cardiac index of 100 percent. Preoperative rest in bed for one, two, or three weeks, with a fluid intake of 6 to 8 pints daily and cardiac tonics, approximates these figures to, say, 130/80, and major operations have then been undertaken with consistently uneventful convalescences.

The opinion at present held as a result of these studies is that the blood-pressure figures in themselves mean little; it is the relation of the diastolic and systolic which matters— i. e., the cardiac index; a high or a low systolic blood pressure between 100 and 200 mm. is immaterial to the surgeon considering a major operation so long as the cardiac index is around 50 percent.—Dodd, H.: Significance of blood-pressure readings in general surgical work; with special reference to cardiac index. Brit. M. J. 2: 811–813, December 25, 1943.

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A TABLET EMERGENCY RATION FOR LIFEBOATS AND RAFTS[1]

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The authorities charged with equipping lifeboats and rafts frequently find it impossible to stow on these craft sufficient food and water to satisfy completely the crew's requirements during the expected maximum number of days before rescue. It has been repeatedly demonstrated that a man ingesting ample water but no food can survive 20 to 30 days, or even longer, provided that he is not subjected to physical strain to which fasting renders him unduly susceptible. On the other hand the maximum time of survival of a person completely deprived of water rarely exceeds 10 to 14 days even under the most favorable circumstances. The maximum recorded period of survival at sea without water is 11 days (*1*). These considerations render it advisable to limit the space allotted to solid food in order to permit stowage of a maximum volume of water.

At the same time it must be remembered that when the daily intake of water is limited to less than 500 cc., the ingestion of a relatively small amount of carbohydrate and fat will maintain an otherwise starving subject in better condition than if this food were replaced with an equivalent weight of water (*2*). Nor should it be forgotten that under certain conditions of shipwreck one is likely to die in a short time from exposure to cold. In such cases food might be of more importance than water in prolonging life.

Except when intrinsic floatability is a prerequisite, an emergency ration should be concentrated, furnishing a maximum number of calories in the allotted space. At the same time it should not cause nausea or vomiting. It should consist of a food substance which can be

[1] From the Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md.

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swallowed with a minimum of difficulty when the mouth is dry and which will cause no subsequent accentuation of thirst. Assimilation of the ration should be accompanied by production of a maximum volume of water of oxidation. Excretion of its metabolic products, nitrogen and inorganic salts, should entail loss of a minimum volume of urine. The components of the ration should lend themselves to easy and equal distribution to the individual survivors on a lifeboat or raft. The constituents should remain unaffected by storage for long periods at the high temperatures frequently encountered in aircraft parked in the sun or in lifeboats stowed on a ship's boat deck. Finally the ration should be packed in a container which will resist battering and wetting encountered in lifeboats and rafts.

An evaluation was made of the shipwreck rations supplied in 1942. These included the U. S. Navy Emergency Rations for Life Rafts and Boats, also known as the Abandon Ship Ration, the Bureau of Aeronautics' Life Raft Emergency Ration, and the Merchant Marine lifeboat and raft ration. Several of the included items, biscuits in particular, proved difficult to swallow when a person became dehydrated. In the Abandon Ship Ration, the amounts of protein and salt were undesirably large. The form of some of the items caused a wasting of space in stowage. In view of these defects, the development of an improved emergency ration was undertaken.

At first it seemed advisable to combine food and water in one item by the development of a liquid ration containing 10-percent solids. Specially canned salt-free tomato juice and beef consommé were provided by a commercial cannery. It was possible to increase the amount of liquid ingested by adding 1 part of sea water to 4 or 5 parts of the ration. Experiments conducted at the Naval Medical Research Institute, and by Butler (*2*) had substantiated British findings that such employment of sea water was beneficial to a slight but definite degree. It had been previously found necessary to leave an empty "head space" in the cans containing the standard aircraft emergency water supplies in order to prevent distortion due to freezing. This head space was thus available for use in measuring the proper amount of sea water to be added.

The Bureau of Ships and Bureau of Medicine and Surgery had contracted with the Nutritional Biochemistry Laboratories of the Massachusetts Institute of Technology to make parallel and more detailed investigations of liquid rations (*3*). The staff of the Boston laboratory cooperated in a joint experiment at the Research Institute.

Fifteen men subsisted for 4 days on a daily intake of 600 cc. of one of several liquid rations. Five parts of tomato juice and consommé were diluted with one part sea water. Two commercial brands of chocolate milk were brought to the same content of sodium chloride

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as the diluted tomato juice and consommé by adding sea water and fresh water. To many of the subjects these 3 simple liquids were definitely more palatable than soups which were blends of meats and vegetables. During the experiment the only solid food allowed was 40 gm. daily of sucrose candy or malted milk. Thirst was minimal. The usual losses of weight observed in fasting subjects occurred.

The experiment demonstrated that these liquids were well tolerated for at least 4 days. It was felt that they might constitute a desirable replacement for "canned" water in emergency kits in which there was little or no space for solid rations, and that a survivor's morale might be improved by the knowledge he was "drinking" food as well as water.

Efforts toward production of a liquid ration were abruptly discontinued when, during the spring of 1943, two satisfactory methods of rendering sea water potable by chemical demineralization were developed. These processes were the Naval Medical Research Institute and the Decalso (Permutit, USA) methods, both of which increased by at least four to six times the volume of water potentially available in a given space. Consequent reevaluation of the problem of equipping emergency kits made it seem advisable to pack the food ration in a solid, concentrated form.

FORMULA FOR THE TABLET EMERGENCY RATION

During subsequent months, a "tablet emergency ration" was developed. The constituent items and their formulas follow:

Item 1. Sucrose-citric acid tablet.—Formula: Sucrose 100 lb.; citric acid 24 oz.; and at least 5 different natural or U. S. certified fruit flavors and colors. The product should contain approximately 15 percent invert sugar, a concentration which may be achieved by such methods as replacing a portion of the sucrose in the formula with invert sugar, or by the use of cream of tartar during cooking.

The sucrose-citric acid tablet is a commercially available candy. The citric acid which it contains increases the flow of saliva and thus facilitates dissolving of the tablet in the dry mouth. This tablet had proved satisfactory as the only source of food during several 3- to 6-day fasting experiments at the Naval Medical Research Institute. In these experiments the subjects were dehydrated.

Item 2. Sucrose-lipid-citric acid tablet.—Formula: Sucrose 50 lb.; corn syrup 28 lb.; fat 22 lb. (this fat should be an edible hydrogenated vegetable fat with congealing point between 27° and 33° C.); citric acid 9 oz.; and butter flavor 33 cc. The batch is heated to 315° F. in 15 minutes and subjected to vacuum without further heat. Citric acid is added at the last possible moment on the cooling table to prevent scorching of the acid.

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The sucrose-lipid-citric acid tablet was developed to contain slightly over 20 percent fat; commercial butterscotch contains less than 1[illegible] percent. The inclusion of fat in a ration is desirable because fat is the most concentrated source of calories available, and when oxidized in the body produces more water than any other food. This is indicated in table 1. Addition of fat to sugar is reported to render the latter less nauseating (*2*) (*4*).

TABLE 1.—*Approximate weight of water produced by oxidation of 100 gm. of basic foods*

Food	Weight of food (gm.)	Water of oxidation (gm.)
Fat	100	[illegible]
Carbohydrate	100	[illegible]
Protein	100	[illegible]

Item 3. Sucrose-malted milk tablet.—Formula: Good quality malted milk 64 lb.; corn syrup 1 lb.; and powdered sucrose 35 lb. This mixture is granulated and pressed into tablets.

The sucrose-malted milk tablets are utilized in the ration because of the five constituents of the present Abandon Ship Ration and the Bureau of Aeronautics' Life Raft Emergency Ration, malted milk alone has met with anything approaching general approval by survivors. Sugar is added to reduce the bitter taste of malted milk, which is offensive to some persons. Citric acid is omitted in order to provide variety of flavor in the ration.

Item 4. Multivitamin tablet.—Formula: Vitamins A and C, and elements of the B series.

The multivitamin tablet is not regarded as an essential item but is included to strengthen morale. It has not as yet been demonstrated that a serious vitamin deficiency can develop in the relatively short period during which an emergency ration will be consumed by survivors. In the event that a definite need for a vitamin supplement is demonstrated, a supply of vitamins adequate for many days can be placed in the first-aid kit of the emergency craft.

Item 5. Sugar-coated chewing gum.—Chewing gum is included because its use moistens and cleans the mouth and may relieve nervous tension. A sugar covering will tend to prevent the flavor of the gum from permeating other items in the ration.

Items 1 and 3 are commercially available in tablets measuring three-fourths by three-fourths by five-sixteenths inch, individually wrapped in cellophane. It may prove necessary to provide the lipid tablet in segmented bar form, due to the technical difficulties encountered in making it into tablets,

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A variety of three types of food items has been provided deliberately, because in numerous experiments at the Naval Medical Research Institute it was found that a variation in the taste of food increases its palatability for subjects on meager rations of water. The proportions suggested for the three food items in the ration have been provisionally set at 25 percent by weight of sucrose-citric acid, 35 percent sucrose-malted milk, and 40 percent sucrose-lipid-citric acid tablets.

The volume occupied by 100 gm. of tablet ration of this composition is slightly less than 6 cu. in. As indicated in table 2, relatively little protein is provided. When oxidized it produces less water than sugar or fat and upon being metabolized it yields urea, which may require extra water for its excretion. The sodium and chlorine contents of the ration vary somewhat with the brand of malted milk used; the other two food items do not contribute salt. Sucrose-malted milk tablets made from Horlick's malted milk were found to contain 0.44 gm. of sodium and 0.37 gm. of chlorine per 100 gm. Thus the content of sodium chloride in the ration is approximately 0.3 gm. per 100 gm. of ration.

TABLE 2.—*Approximate distribution of nutrients in tablet emergency ration*[1]

	Carbohydrate gm. per 100 gm.	Protein gm. per 100 gm.	Fat gm. per 100 gm.	Calories per 100 gm.
Sucrose-citric acid tablet	100			400
Sucrose-lipid-citric acid tablet	76		24	520
Sucrose-malted milk tablet [2]	80	10	6	410

[1] 100 gm. of the ration, including respectively 25, 40 and 35 gm. of the 3 items, supply about 84 gm. of carbohydrate, 4 gm. of protein, and 12 gm. of fat, equivalent to 460 calories; i. e., 4.6 calories per gm.
[2] Contains about 4 percent moisture.

When the tablet ration, sealed in wax paper, was stored for 8 weeks at 122° F., the lipid tablets darkened, softened temporarily, and exuded a little of their fat, but their taste remained essentially unchanged. The sucrose-malted milk tablets were observed to swell slightly during this storage test; this response to heat is apparently characteristic of all malted milk tablets.

It is of interest that similar rations of the candy type have been developed by other groups. For several months the Royal Air Force has been using an emergency ration of barley sugar and malted milk tablets, and the Army Air Force has stocked its pneumatic rafts with sucrose-citric acid tablets. Butler has emphasized the value of a "butterscotch" candy ration (*4*).

PRACTICAL EXPERIENCE WITH THE TABLET RATION

The tablet emergency ration was the only food furnished to 18 volunteers who spent 4 days on pneumatic life rafts under tropical con-

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ditions in the Gulf of Mexico in July 1943. The subjects received up to 340 calories of the ration, or 75 gm., daily during the 4 days. The relative amounts of each item issued were, by weight, 4 parts sucrose-citric acid tablets, 2 parts sucrose-lipid-citric acid tablets and 1 part sucrose-malted milk tablets. This ratio of distribution was purely arbitrary. Although the daily fluid intake was less than 500 cc., evaporative water loss was at a minimum and thirst was not a general complaint. Thirst was not precipitated by ingestion of the ration. All 3 types of tablets, particularly the sucrose-lipid-citric acid tablet, met with general approval. Hunger was satisfied.

Two factors were operating which commonly reduce the appetite of survivors to a minimum, i. e., a tendency to seasickness and incipient dehydration. There is some evidence that when seasickness is imminent the sweetness of the tablet ration renders it less acceptable than a biscuit. Twelve of the subjects consumed less than the daily issue of 75 gm. The condition of the subjects at the end of the 4 days was good, although they exhibited the usual weight loss of semifasting subjects on a limited intake of water. The amount of ration issued was not sufficient to prevent the appearance of acetone in the urine.

Butler, while conducting experiments under a contract with the Committee on Medical Research of the Office of Scientific Research and Development (*4*), has fed 2 subjects daily for 7 days 150 gm. of sucrose-lipid candy (butterscotch) containing 20 percent fat; in addition, 400 cc. of water was allowed per day. It was noted that a ration containing fat caused less nausea than one consisting wholly of carbohydrate. Test subjects found that the butterscotch ration, which provided 750 calories daily, caused less nausea, abdominal distress and general malaise than did ingestion of the prescribed daily allowance of the present Navy Abandon Ship Ration, which consists of 300 gm. (1,040 calories) of biscuit, pork luncheon meat, and malted milk tablets. Butler concluded that "the present emergency lifeboat ration of 300 gm. per day is less suited to the conditions of limited space and water commonly available on life rafts than is a simple butterscotch ration of but 150 gm. per day. The present emergency ration, therefore, wastes 150 gm. per man per day of boat space which, if used for water, would be utilized far more effectively" (*4*).

Daily allowance.—Existing evidence indicates that "the amount of food that can be ingested with benefit under life raft conditions and limited fluid intake is relatively small" (*4*). Butler observed that a daily intake of 150 gm. of his butterscotch ration seemed a satisfactory allowance for these conditions. In view of his findings and of those of the Naval Medical Research Institute at the trials in the Gulf of Mexico, the recommended daily allowance has been set at 150 gm. per man, supplying about 690 calories. The amount supplied daily should not drop below 75 gm., unless limitation of storage space is extremely

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stringent. On the basis of the emergency craft's rated capacity, 75 to 150 gm. of the ration should be stowed for each man for each day of the maximum number of days expected to pass before rescue.

CONCLUSIONS

In June 1943 the Chief of the Bureau of Medicine and Surgery recommended that the Bureau of Aeronautics' Emergency Life Raft Ration consisting of pemmican, chocolate, and malted milk be replaced by the tablet emergency ration. The latter is now being procured for the kits of pneumatic rafts. In addition, it is felt by the authors that the tablet ration compares more favorably with the ideal emergency ration for shipwreck than do the present shipwreck rations employed by the Navy and the Merchant Marine. These rations are composed of biscuit, luncheon meat or pemmican, chocolate, and round malted milk tablets. The tablet ration is preferable, particularly from the point of view of its palatability, when the mouth tends to be dry. It is also more desirable because its content of nitrogen and salt is low. The compactness of the tablet ration is an advantage in situations in which intrinsic floatability is not a prerequisite.

The use of the tablet emergency ration merits consideration wherever a concentrated ration is needed for a short period of time, say 1 to 5 days. It would prove useful to those involved in crashes of aircraft in the wilderness, parachute maneuvers, or landing operations. In all these situations the supply of water may be limited. It was for just such a situation that the tablet emergency ration was designed.

SUMMARY

1. A concentrated ration, designated the "tablet emergency ration," has been developed. Its three food components are sucrose-citric acid, sucrose-lipid-citric acid, and sucrose-malted milk tablets.

2. The ration is compact, contains only small amounts of sodium chloride and protein, and can be ingested with a minimum of difficulty when the mouth is dry.

3. The tablet emergency ration is recommended for use on life rafts and lifeboats, and in certain other situations where it is desired that a concentrated ration be available for use over a limited number of days.

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COMPARISON OF FOUR ROUTINE PROCEDURES IN TH TREATMENT OF ACUTE CATARRHAL FEVER

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"Catarrhal Fever, Acute" is a comprehensive term which has bee adopted by the Medical Department of the Navy to include generalize respiratory infections with febrile reactions. It includes such conditions as acute rhinitis, pharyngitis, laryngitis, tracheitis, bronchitis etc., where the infection is not sharply localized, and is manifeste rather by fever, malaise or other constitutional symptoms. It is th condition commonly termed a "cold," "grippe," or "influenza." Th terminology is advantageous in that it is inclusive and denotes a definite clinical picture without the necessity for extensive description It is usually the most frequent medical condition encountered in troop concentrations in certain seasons.

The treatment of catarrhal fever is nonspecific since the infections encountered range from different virus infections through a host of bacterial invasions of such organisms as staphylococcus, streptococcus, pneumococcus, micrococcus catarrhalis, etc.

The condition is self limited and responds promptly to hospitalization with routine nursing care. Complications under such care are relatively rare and the symptoms disappear as a rule within a week. In addition to bed rest and nursing care, measures commonly adopted are more or less symptomatic and include abundant fluids, especially fruit juices, the use of anodynes and antipyretics, such as the time-honored aspirin-phenacetin-caffeine capsule, nasal sprays, gargles, steam inhalations, etc.

During the winter of 1942–43, when catarrhal fever cases were numerous, it was decided by the medical staff of this hospital to try

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ious treatment routines and determine if any were significantly erior. The routines decided upon were as follows:

Group 1 (Control).—This group was to receive bed rest, general sing care, abundant fluids during febrile periods, sedatives when icated, codeine whenever necessary for severe cough only, and laxa-es if and when indicated. In addition to these general measures lacebo capsule of milk sugar was to be given every 4 hours.

Group 2.—In addition to the general measures noted in group 1, s group was to receive 2 capsules every 4 hours. Each capsule con-ned aspirin grains 3, phenacetin grains 2, caffeine citrate grain 1, is elixir of terpene hydrate and codeine whenever necessary for igh. These measures had long been in use here, had been found isfactory and were generally accepted because of the prompt relief symptoms usually afforded.

Group 3.—In addition to the general measures outlined in group 1, is group was to receive sulfadiazine, gm. 2, on admission, followed gm. 1 every 4 hours until the temperature had been normal for 48 urs.

Group 4.—General measures as in group 1 plus a special capsule ntaining codeine sulfate grain ½ and ephedrine sulfate grain ⅜, 3 nes a day after meals and 2 at bedtime, was the treatment for this oup.

Four wards of approximately 45 beds each were available for this udy and only 1 procedure at a time was used on a ward. Thus all 4 outines were in effect simultaneously under 4 different ward officers. n order to minimize as much as possible the personal element in the valuation of the treatment routines these procedures were shifted rom one ward to another at regular intervals.

In the evaluation of routines it was felt that the average febrile eriod, the average period of hospitalization, and the clinical impres-ions of the ward officers would offer the best criteria. Results are ummarized in table 1.

TABLE 1.—*Summary of results of various routine procedures*

Treatment routine	No. of cases	Average febrile period (days)	Average hospital period (days)	General clinical course	Remarks
No. 1	228	3.3	6.7	Unsatisfactory	Patients generally uncomfortable. Much coughing. Impression of more frequent pneumonic complications.
No. 2	194	2.6	6.2	Good	Patients generally comfortable, except for frequent drenching sweats.
No. 3	309	2.1	5.6	Satisfactory	Shortest febrile and hospital periods. Patients not as comfortable as with routines Nos. 2 and 4. Infrequent complications.
No. 4	96	4.0	7.3	do	Patients most comfortable on his routine. Little coughing. Much sleeping. This routine, however gave longest period of illness.

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COMMENT

The shortest average febrile and hospital periods were obtained in routine 3, in which sulfadiazine was given. Next to this was routine 2, with the use of aspirin-phenacetin-caffeine capsules. The longest periods were found in routine 4, in which codeine and ephedrine were employed. Group 1, in which only a placebo was given, was in third place.

Despite the low score for codeine and ephedrine as to the duration of illness, this medication held a decided clinical advantage in that the patients were more comfortable than in the other 3 groups. The reason for the inclusion of this combination is found in the work of Diehl, who reported a definite shortening of the duration of respiratory symptoms when codeine and papaverine were routinely employed. The recommended dosage was grain ¼ of each 3 times daily after meals, and grain ½ of each at bedtime. In this study ephedrine was substituted for papaverine, as the latter was not obtainable. Diehl's compound has been widely used by the profession and is still popular.

The phenacetin-compound treatment has long been an accepted form of therapy. This combination promptly relieves the aches and pains so frequently associated with catarrhal fever and thus affords comfort and a sense of well-being. The average hospital and febrile periods were about a half day longer than with sulfadiazine, which places it in second place on that score. A distressing side effect, however, is the tendency to produce drenching sweats, with the necessity for frequent change of garments and the danger of chilling.

It is not surprising that sulfonamide treatment gave the best score as to febrile and hospital days, in view of its well-known effect on numerous infections. Even when given in such small dosage as 1 gm. daily as a prophylactic measure in the control of a scarlet fever epidemic, "a pronounced reduction in the number of sick calls due to other respiratory complaints" was noted.[1]

The question is whether the risks attendant upon the taking of sulfonamides are sufficient to outweigh the advantages in so mild an infection as the average case of catarrhal fever. It is the opinion of the authors that when proper precautions are taken, the risks of sulfonamide therapy are not great. An adequate fluid intake, and the use of sufficient alkali to keep the urine at a pH of 7.5 or above are sufficient to prevent urinary complications with the average dosage.

Occasional skin reactions may be encountered due to an idiosyncrasy. Three such cases were noted in the present study. These however were not of great severity and receded on withdrawal of the drug.

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[1] Watson, R. F.; Schwentker, F. F.; Fetherston, J. E.; and Rothbard, S.: Sulfadiazine prophylaxis in epidemic of scarlet fever. J. A. M. A. 122: 730–733, July 10, 1943.

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The saving of time in sick days and the almost certain prevention of more severe pulmonary complications in a certain percentage of catarrhal fever cases make the sulfonamides the measure of choice for routine therapy. The saving of 1.1 hospital days in a single case may not be significant but multiplied by 827 cases, the total of this study, it amounts to 910 man-days saved to the war effort. Assuming the same relationship exists, the total saving for all such cases in the armed services mounts to important proportions.

Combining the results from all routines and weighing relative advantages, it would appear that a combination of sulfadiazine therapy with the routine use of sufficient codeine to render the patient comfortable, together with general measures and good nursing care, would constitute the best treatment at present available.

SUMMARY

1. A comparison of 4 routine measures in the treatment of acute catarrhal fever has been made in a series of 827 patients. The procedures included a control group in which only nursing care and general measures were employed, a group in which phenacetin-compound capsules were added, a group in which sulfadiazine formed the basis of treatment, and a group in which codeine sulfate and ephedrine were administered.

2. Judged from the febrile and hospitalization periods the sulfadiazine gave the best results. No toxic manifestations were encountered except for three cases which showed cutaneous eruptions. These subsided on discontinuance of the sulfonamide.

3. Patients were most comfortable when taking phenacetin-compound capsules, or codeine and ephedrine. The former has the disadvantage of producing frequent drenching sweats.

4. It is concluded that the routine employment of sulfadiazine with sufficient codeine to render the patient comfortable, combined with general measures and good nursing care, constitutes the best treatment at present available.

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UNTOWARD EFFECTS OF TRANSFUSION

Frequently it is difficult to say whether a given transfusion is the cause of an untoward effect or whether this untoward reaction is a consequence of the patient's illness or a surgical operation. A few of the more commonly observed reactions are: Reactions due to defects of technic, hemolytic reactions, allergic and anaphylactic reactions and transmission of infectious diseases.—SELDON, T. H.; LUNDY, J. S.; and ADAMS, R. C.: Transfusions of blood and plasma. Anesthesiology 5: 22–32, January 1944.

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SAFE UNIVERSAL BLOOD

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There is a definite military need for a blood transfusion technic which will eliminate delay and danger. Such practical procedure was suggested by hearsay evidence that pooled type O blood had been freely administered in both the Spanish Civil War and the campaign in North Africa.

The danger considered inherent in the use of universal blood is commonly ascribed to the high content of iso-antibodies capable of causing agglutination and hemolysis of the recipient's cells—the basis of the term, "dangerous universal donor" (*1*). The agglutinin titer of type O serum was found to be 1/32 or higher in 42.3 percent against A cells and 32.7 percent against B cells. Gesse (*2*) has reported that an agglutination titer of 1/32 or higher of the donor's serum against the patient's cells may cause a hemolytic reaction, particularly if anemic patients with low red cell counts are transfused with more than 200 cc. of blood.

From the foregoing, it is safe to assume that high titer anti-A and anti-B agglutinins in type O donor serum are at least a factor in the production of dangerous hemolytic reactions following the use of "universal blood."

Highly technical procedures have been developed by Landsteiner (*3*) and others (*4*) to produce specific substances which can be added to type O blood to "neutralize" the A and B agglutinins. To date these substances have not received wide use, and regardless of their possible excellence are not available to the naval forces of the present war. Other titer-testing procedures to eliminate high titer type O bloods are more time consuming than the selection of homologous compatible types. Since it is well known that the titer may drop in the course of the production of pooled typing serum, we decided to try pooled type O blood for transfusions without preliminary cross-matching.

PREPARATION OF POOL

In this bank blood is collected by the open technic, directly into bottles containing 50 cc. of preservative whose content is as follows:

Sodium citrate	2.5 gm.
Sodium sulfathiazole	1.0 gm.
Sodium merthiolate	0.05 gm.

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TABLE 1.—*Type A cells with type O plasma*

	Pool 1		Pool 2		Pool 3		Pool 4		Pool 5		Pool 6		Pool 7		Pool 8		Pool 9
	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate
Individual titers:																	
1	1/16		1/16		1/4		1/16		1/8	1/8	1/16	1/32	1/32	1/32	1/16	1/16	1/16
2	1/16		1/16		1/8		1/8		1/8	1/8	1/16	1/16	1/32	1/32	1/4	1/4	1/32
3	0		1/16		1/32		1/16		1/8	1/32	1/64	1/64	1/4	1/4	0	1/4	1/32
4	1/16		1/16		1/4		1/8		1/8	1/8	1/32	1/32	1/16	1/16	1/8	1/8	1/8
5	1/16		1/16		1/32		1/64		1/8	1/8	1/32	1/32	1/16	1/16	1/8	1/8	1/32
6	0		1/2		1/64		1/32		1/8	1/16	1/32	1/32	1/16	1/16	1/4	1/4	1/16
7	1/16		1/64		1/32		1/16		1/16	1/64	1/4	1/8	1/16	1/16	1/32	1/32	1/64
8	1/4		1/8		1/8		1/8		1/8	1/16	1/32	1/32	1/16	1/16	1/8	1/8	1/64
9	0		1/16		1/16		1/16		1/4	1/8	1/32	1/32	1/16	1/16	1/8	1/8	1/64
10	1/16		1/64		1/8		1/32		1/8	1/8	1/32	1/32	1/64	1/64	1/32	1/32	1/8
Pool titer	1/4		1/16		1/16		1/16		1/8	1/8	1/16	1/16	1/16	1/16	1/8	1/8	1/8

Dilutions were carried to 1:128 and 1:356; no positive readings were obtained at the higher levels.

As soon as the reports of satisfactory serology are obtained, and using the simplest of ordinary bacteriologic technic, 10 half-liters of whole blood are poured into an Erlenmeyer flask and immediately redivided into 500-cc. amounts after gentle mixing. A residual 25 cc. is taken from the large flask and part is used for culture in thioglycollate medium (technic of the National Institute of Health), and part is placed in a pilot tube. The erythrocytes settle promptly in the pilot tube and the crystal clear, straw-colored, supernatant plasma without hemolysis, confirms the absence of any cells other than type O in the pool, and helps to establish the fact that the blood has been handled gently throughout. All procedures are carried out at room temperature and the blood is maintained 5 days, if needed, at that temperature.

TABLE 2.—*Type B cells with type O plasma*

	Pool 1		Pool 2		Pool 3		Pool 4		Pool 5		Pool 6		Pool 7		Pool 8		Pool 9
	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours	Immediate
Individual titers:																	
1	1/8		1/4		1/2		1/8		1/4	1/8	1/32	1/32	1/8	1/8	1/4	1/4	1/4
2	1/8		1/8		1/2		1/16		1/8	1/8	1/16	1/16	1/16	1/16	0	0	1/4
3	1/4		1/4		1/32		1/4		1/4	1/16	1/32	1/32	0	0	3	1/4	1/4
4	1/8		0		1/4		1/8		1/4	1/8	1/32	1/32	1/4	1/8	1/4	1/8	1/8
5	1/8		1/2		1/32		1/8		0	0	1/32	1/32	1/16	1/16	1/4	1/4	1/16
6	1/8		1/8		1/32		1/8		1/2	1/8	1/8	1/16	1/8	1/8	1/4	1/4	1/4
7	1/16		1/16		1/16		1/4		1/8	1/8	1/4	1/4	1/8	1/8	1/4	1/8	1/8
8	1/8		1/4		1/16		1/4		1/8	1/8	1/8	1/8	0	0	1/4	1/4	1/4
9	1/8		1/4		1/8		1/2		1/8	1/8	1/16	1/16	1/16	1/16	1/8	1/8	1/4
10	1/8		1/32		1/4		1/8		0	0	1/16	1/16	1/16	1/16	1/8	1/16	1/16
Pool titer	1/8		1/4		1/16		1/8		1/4	1/4	1/16	1/16	1/2	1/8	1/4	1/4	1/4

Dilutions were carried to 1 : 128 and 1 : 356; no positive readings were obtained at the higher levels.

The final administration, without cross-matching, is performed with the constant pressure bulb and inverted bottle as previously described

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(*5*). By this method an absolute minimum of rubber tubing is required and the cleaning problem simplified. A constant pressure bulb is used to obtain any flow desired and to eliminate the chance of any backflow of blood into the pressure bulb. In this hospital all whole blood, as well as plasma, is administered by corpsmen trained at this plasma center.

TECHNIC OF TITRATION

Titration of all individual and pooled plasma and serum was performed according to the method of Weiner (*6*), in principle the same as that of Coca (*7*).

TABLE 3.—*Type A cells with type O serum*

	Pool 1		Pool 2		Pool 3	
	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours
Individual titers:						
1	1/32	1/16	1/64	1/64	1/16	1/8
2	1/16	1/16	1/8	1/16	1/32	1/64
3	1/64	1/64	1/64	1/64	1/16	1/64
4	1/16	1/32	1/8	1/32	1/4	1/16
5	1/32	1/32	1/32	1/32	1/8	1/64
6	1/64	1/64	1/64	1/64	1/16	1/32
7	1/32	1/32	1/8	1/16	1/16	1/64
8	1/64	1/64	1/32	1/32	----------	----------
9	1/64	1/64	1/16	1/16	----------	----------
10	1/32	1/32	1/64	1/64	----------	----------
Pool titer	1/64	1/64	1/32	1/32	1/16	1/32

Serum obtained by clot retraction. No citrate, sulfathiazole, or merthiolate present.

Titers were read 90 minutes after the addition of A and B cells to the dilutions of serum or plasma. As a check for the accuracy of the macroscopic readings one drop each of the suspension from the last 2 positive and 1st apparent negative tubes were placed on a slide and observed microscopically. The results in all cases were found to be the same.

No observations have been made on the titer of pooled O plasma without chemical preservatives, nor have we studied the level of titers in serum pools with the preservatives present. At the moment these data would have minimal practical significance. In the future, along with the increase in number of transfusions to be recorded, such a study may be undertaken.

CLINICAL DATA

Patients were accepted without reservation or selection except for one consideration. As nearly as possible they were chosen for acute conditions requiring 2 to 6 transfusions fairly rapidly. This selection helped us to simulate battle conditions and avoid the multiple complication factors which enter when a long series of transfusions is performed. One exception to this rule was allowed in an instance not

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to be included in the gross figures presented. A post-midthigh-amputation patient was treated with 38 transfusions of pooled type O blood, over a period of 40 days. There was no untoward reaction to the blood, but the patient underwent an apparent change of blood type, from A to O, after the 30th transfusion.

TABLE 4.—*Type B cells with type O serum*

	Pool 1		Pool 2		Pool 3	
	Immediate	48 hours	Immediate	48 hours	Immediate	48 hours
Individual titers:						
1	1/32	1/32	1/32	1/32	1/4	1/4
2	1/16	1/16	1/16	1/32	1/32	1/32
3	1/16	1/16	1/16	1/16	1/8	1/32
4	1/16	1/4	1/32	1/32	1/4	1/4
5	1/32	1/16	1/8	1/16	1/4	1/4
6	1/8	1/16	1/32	1/32	1/16	1/32
7	1/32	1/32	1/16	1/16	1/8	1/64
8	1/64	1/64	1/32	1/32	----------	----------
9	1/32	1/32	1/32	1/32	----------	----------
10	1/16	1/8	1/4	1/8	----------	----------
Pool titer	1/16	1/32	1/32	1/32	1/4	1/32

Serum obtained by clot retraction. No citrate, sulfathiazole, or merthiolate present.

The diagnoses on patients in this series include: Gastritis, acute; fractures; lacerations; wounds; intestinal obstruction; malaria; hematemesis; liver abscess; rheumatic fever; and operative shock, with and without hemorrhage.

A total of 98 patients received a total of 240 pooled type O transfusions. Of these, 40 (39.2 percent) were type O, 55 (55.1 percent) type A, and 3 (4.7 percent) type B. No type AB was encountered.

The possibility of the significance of M and N factors, and any relationship to the Rh factor was not investigated in relation to this work, because of the practical military purposes for which the method was designed.

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EPIDEMIC DENGUE

ITS ABORTION IN A COMBAT AREA

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The dissemination of communicable disease through rapid transport facilities constitutes a major military problem. The frequent and rapid transfer of infected personnel and vectors from endemic or epidemic areas to healthy areas may easily bring disaster to those not cognizant of its potential danger. The importance of early recognition of an impending epidemic and the knowledge of proper control methods cannot, therefore, be overemphasized.

This report concerns an outbreak of dengue, popularly known as "tropical flu" or "break-bone fever," occurring in a South Pacific island of military importance, which was aborted in its incipiency by timely attention to a few elemental epidemiologic principles.

Dengue is not a serious disease in terms of mortality but has a very high morbidity, especially among troops, when it occurs in epidemic form. According to Stitt, not infrequently more than half the population rapidly acquires this most incapacitating of epidemic diseases. The explosive suddenness of onset and temporary severity of symptoms which characterize the disease render its victims immediately unfit for duty for about 7 to 10 days. It is obvious that a high incidence of this disease in a military camp or organization operating under combat conditions could quickly paralyze its fighting strength.

Dengue is caused by a filterable virus, transmitted by the mosquito, Aëdes aegypti. The disease is characterized by sudden onset of fever, malaise, headache, generalized aching, cervical adenopathy, and leukopenia with relative lymphocytosis. Its usual duration is 5 to 7 days. A transitory remission of fever and symptoms occur usually about the 3d or 4th day of the illness, and often a generalized scarlatiniform rash appears.

After being bitten by an infected mosquito, 4 to 10 days elapse before symptoms develop in the susceptible individual. The virus is present in the peripheral blood of the victim only during the first 4 days of the

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disease. If the patient is bitten during this time by a noninfected Aëdes aegypti mosquito, 8 to 11 days elapse before the mosquito is capable of transmitting the infection. The mosquito then remains infectious for life, which may be as long as 4 months.

The Aëdes aegypti can breed in any stationary collection of water, no matter how small. Seven to 10 days normally elapse before the ova, larva, and pupa stages have passed and the mature mosquito is ready for flight. The adult mosquito rarely makes its home more than a few yards from human habitation, and its range of flight does not exceed a few hundred yards. Its habits are diurnal, the period of greatest activity being at dawn and dusk.

Sanitary survey had disclosed the presence in large numbers of the Aëdes aegypti on this island. Since practically all of the personnel had never had dengue, conditions were ideal for the production of an epidemic should the organisms be introduced on the island.

Island X is part of a typical coral atoll in the Southwest Pacific. It is liberally sprinkled with palm trees and has several patches of swamp in which taro grows. The sole source of water for washing is the rain which is caught as it flows off roofs and tent sides and is stored in barrels. Its nearest neighbor, Island Y, is 450 miles away. Between the two islands there was free intercourse by sea and air. Some months before Island X had been subjected to enemy attack several times and all personnel possible was kept in combat readiness constantly.

Despite the fact that an extensive dengue epidemic existed on Island Y and that the disease was introduced originally by aviation personnel arriving from Island Y, military reasons precluded any curtailment of free traffic between the islands.

INTRODUCTION AND COURSE OF OUTBREAK

On 22 July 1943, four men, all from the same aviation unit, reported to sickbay complaining of headache, backache, and periorbital pain. All were febrile. One had arrived from Island Y on 14 July and three on 19 July. The first man stated that he had felt ill and feverish for several days. The following day two more men from the same unit were admitted with similar complaints. Simultaneously it was learned that dengue had spread on Island Y in epidemic proportions.

The diagnosis was established by the history of exposure at Island Y, the characteristic symptomatology and physical findings, and the laboratory evidence of leukopenia with relative lymphocytosis.

The imminent danger to local personnel was immediately apparent. A program of epidemiologic control was outlined and immediately placed in operation—none too soon, as on 27 July the first cases among local personnel appeared.

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A brief summary of the clinical features as they occurred in our series might be helpful to those whose experience with the disease has been limited. All patients complained of malaise, headache, and backache. Ninety percent noted retro-ocular or periorbital pain; 75 percent experienced moderate to severe arthralgia or myalgia. The onset of illness, generally abrupt, was accompanied by chills in two-thirds of our cases. Anorexia was a frequent symptom, while nausea and vomiting were present in about one-third of the cases.

Physical signs observed with greatest frequency were fever (100.6° F. to 104° F.); lymphadenopathy, especially of the posterior cervical group (90 percent); conjunctivitis (75 percent); pharyngeal lymphoid hyperplasia (65 percent); palpable spleen (25 percent), and a rash (40 percent). The rash varied in appearance and extent, usually being scarlatiniform in character and involving the chest, abdomen, and extensor surfaces of the extremities. It appeared on the 3d to 6th day of illness, frequently at the time of remission of fever, and lasted 12 to 48 hours.

Leukopenia below 4,000 was observed in half the cases; slightly reduced or normal leukocyte counts were present in the remainder. Relative lymphocytosis of 40 to 60 percent was commonly observed.

Bradycardia or marked hypotension were not observed, although asthenia persisting for as long as 2 weeks following discharge was frequent. A characteristic "saddle" temperature curve with remission on the 3d day or 4th day of the illness and recurrence the following day occurred in four-fifths of the cases. Treatment consisted of sedatives, antipyretics, and a liquid high-caloric diet.

CONTROL PROGRAM

As pointed out previously, due to military necessity no curtailment of traffic by air or sea between Island X and Island Y could be tolerated. This meant that there would be a constant influx of infected personnel which would continue until the epidemic on Island Y abated.

The problem resolved itself into four parts: (1) Care and disposition of the patients; (2) observation of known contacts; (3) handling of the remainder of the personnel; and (4) extermination of the insect vector.

Care and disposition of patients.—The patients were placed in a screened isolation camp provided with laboratory, galley, and head facilities. The site chosen combined the several factors calculated to reduce the possibility of spread of the disease. Situated well away from barracks and thickly populated areas, it was far beyond range of flight of the Aëdes mosquito. Located near the ocean, the encampment was subject to a brisk breeze all the time. Not only did the latter

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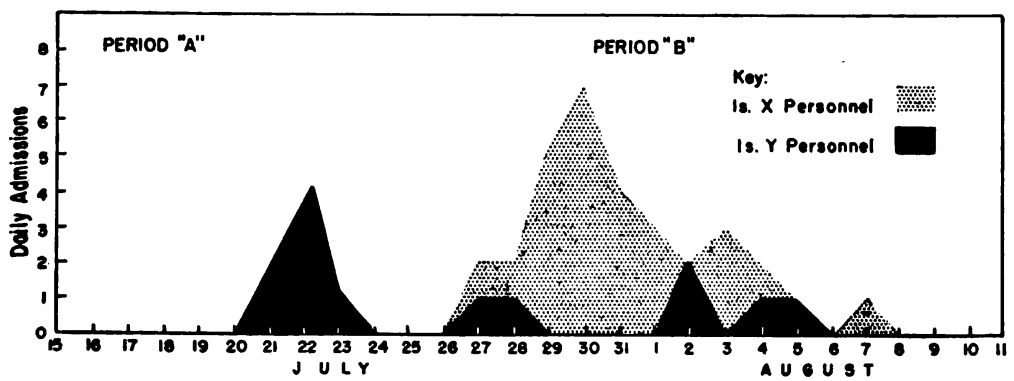
contribute materially to the comfort of febrile patients but it materially reduced the mosquito population. As a further precaution all underbrush and breeding places were eliminated from the area. Nevertheless patients were kept under mosquito netting continually for the first 5 days of their illness.

Observation of known contacts.—Military necessity precluded quarantine. All men living in the same area as the original patients were checked twice daily for fever and symptoms for the longest period of incubation of the disease (10 days). They were instructed to be fully clothed all day and exposed parts were covered with a proprietary insect repellent. They slept under netting and their quarters were sprayed with aerosol bombs of a Navy approved insecticide. All men arriving from Island Y were examined on arrival and, if afebrile and asymptomatic, were treated as known contacts.

Handling of remainder of personnel.—An order was issued to all personnel on the island to wear shirts and full-length trousers throughout the day. The symptoms of dengue were described and anyone who felt even mildly ill was instructed to report to sickbay.

Extermination of the insect vector.—The sanitation officer made a careful inspection of the entire island with a view to discovering active or potential breeding places for mosquitoes. Swamps were ditched and either filled in or oiled regularly. All debris that could serve as water receptacles, such as cans, bottles, cocoanut shells and the like, was cleared out or burned. Underbrush for a distance of 75 yards from the nearest bivouac areas was cleared; rain barrels were covered with target cloth, and once a week the surface was sprayed with a drain oil-kerosene mixture (2:1). It was found incidentally that several barrels covered with standard 18-mesh wire screen contained mosquito larvae, and a change to target cloth was advised.

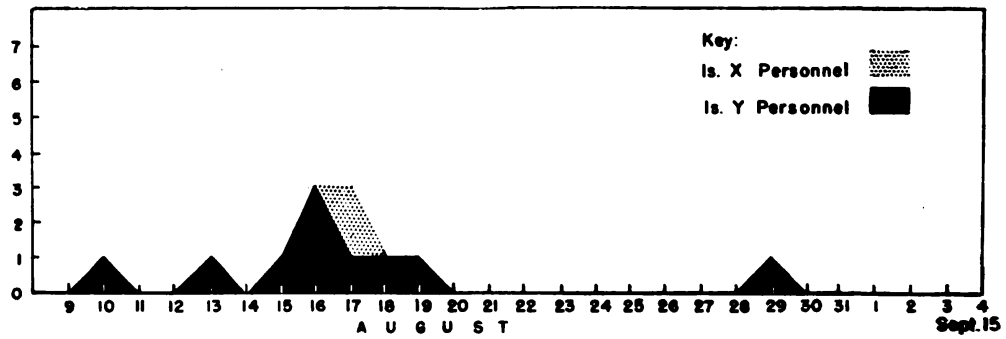
All planes arriving from Island Y were met and the cargo and interior were sprayed with aerosol. All incoming vessels were boarded and inspected by the sanitation officer for the presence of dengue cases or contacts. The results of the control program are shown in the accompanying graphs.



1. Representing a "single cycle" outbreak of dengue.

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In figure 1 Period "A" represents introduction of the disease by personnel who first arrived from Island Y (solid black areas) and the time interval elapsing before the appearance of the initial cases in Island X personnel. Period "B" shows the sharp rise followed by rapid decline in cases among Island X personnel (dotted areas) with the institution of the control program. This represents epidemiologically a "single cycle" of infection. It is the critical time, for epidemics or pandemics occur when such cycles of infection are allowed to recur and subsequently to overlap other cycles, the number of cases increasing in geometric proportion. It is interesting to note from a careful study of this graph that all cases admitted in Period "B" must have received their infection during Period "A". Less than 1 percent of Island X personnel was infected, whereas 40.3 percent of the average strength of Island Y had the disease between 1 July and 31 August.



2. Showing continued influx of dengue with abortion of epidemic following institution of control program.

Figure 2 shows the continuous arrival of infected personnel from Island Y from 9 August to 31 August. It is evident that the constant threat to Island X personnel persisted. Nevertheless after the initial outbreak of 27 cases among Island X personnel within a period of 12 days (fig. 1), only 2 cases developed despite the continuous influx of patients from Island Y (fig. 2). This we feel demonstrates the effectiveness and feasibility of control measures, rigidly applied and persistently carried on, despite the limitations necessitated by the existing military situation.

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A NEW RETAINING DEVICE FOR NASAL STOMACH TUBES

A woman's metal earring, stripped of its jewelry so that nothing remains but its essential "U" shaped clamping device, when clamped to the nasal columella, has proved to be a useful, comfortable, and easily appliable "gadget" for retaining a nasal-stomach catheter. The tube is loosely tied to the earring by a piece of small twine or thread. This method is thought to be superior to the adhesive tape method and so far as is known has never before been used.—Dixon, Thomas, Lieutenant Commander (MC) USNR.

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MUMPS MENINGITIS

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In a recent study of mumps the authors (*1*) directed attention to the high incidence of meningitis and the marked pleocytosis of the spinal fluid in many of their cases. Of the 38 patients studied only 8 had spinal fluid cell counts of 10 or less.

In 1902 Monod (*2*) was the first to demonstrate that there was an increased number of lymphocytes in the spinal fluid in cases of mumps even when there was no clinical evidence of meningitis. This fact was shown in 6 of 8 observed cases. Chauffard and Boidin (*3*) in 1904 described a lymphocytosis in the spinal fluid in mumps and considered it a complication of the disease. Since then a number of papers have appeared on the complications of mumps affecting the central nervous system.

A new hypothesis as to the origin of the disease was offered by Bezançon and Philibert (*4*) in 1926. It was their belief that mumps should be interpreted as a primary encephalitis with secondary localization in the parotids, salivary glands, testicle, pancreas, etc. In 1932 Philibert (*5*) offered additional evidence to support this view. He presented the following facts substantiating his conclusions:

1. The virus can be demonstrated in the spinal fluid.
2. Frequently the virus causes an inflammatory process which reflects itself by a pleocytosis in the spinal fluid and often in clinical meningitis.
3. A number of cases of meningitis have been reported which preceded the parotitis (*6*). This opinion has been concurred in by Weissenbach, et al. (*7*), who believe that the nervous system is involved primarily and other organs secondarily.

Recently Wesselhoeft (*8*) has stated that mumps is now looked upon as a systemic disease.

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The concept of primary central nervous system involvement is indeed a very novel one and should stimulate further investigation. In this paper, we shall employ the commonly accepted terminology of the parotitis as primary and the meningitis as secondary focus without taking sides in the issue involved.

Montgomery (*9*) has noted the frequency of meningitic involvement varies with the epidemic. Brooks (*10*) studied 1,059 cases of mumps at Camp Upton during World War I and found no meningitis. Of Frankland's (*11*) 234 cases, 30 percent had signs and symptoms of meningeal involvement. He felt that the particular virus was neurotropic. Since February 1915 de Massary et al. (*12*) have studied 635 soldiers with mumps and only 16 had clinical meningitis. However they also studied intensively 40 additional cases of uncomplicated mumps. Of these 56 patients, a normal number of cells in the spinal fluid was found only seven times.

The first group in our study was made up of 14 patients who were admitted with parotitis and whose clinical course was uncomplicated. They could be divided into two types as evidenced by the fever chart. The first type was observed in 5 who were afebrile on admission and remained so throughout. The second type showed fever on admission, but it returned to normal after 2 to 4 days. There were 9 of these. Of the 14, only one complained of headache. Chart 1 is typical of the second type.

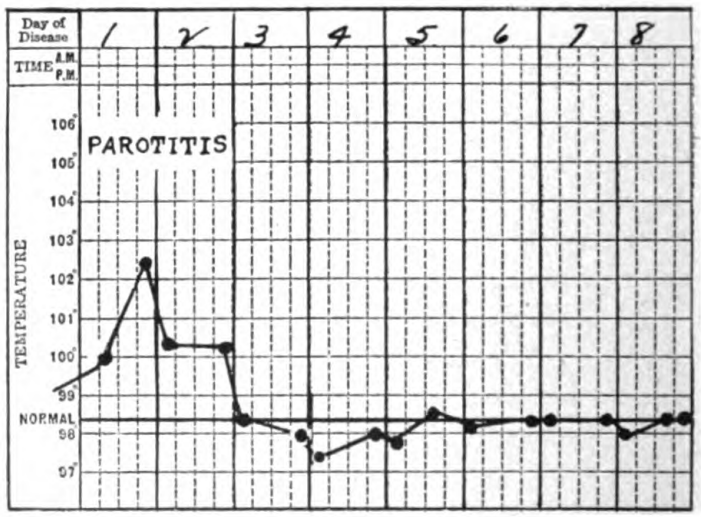


Chart 1.—Patient 7. Uncomplicated mumps.

Table 1 is a résumé of our findings on cell counts of spinal fluid examinations done on the patients with uncomplicated mumps.

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TABLE I.—*Uncomplicated mumps*

Case number	Cell count spinal fluid*	Case number	Cell count spinal fluid*
1	$20^{(7)}$	8	$7^{(8)}$
2	$6^{(6)}$ $35^{(6)}$	9	$146^{(8)}$ $87^{(10)}$
3	$42^{(5)}$ $23^{(6)}$	10	$1^{(5)}$ $6^{(6)}$
4	$4^{(6)}$ $8^{(6)}$	11	$1^{(5)}$ $7^{(7)}$
5	$24^{(6)}$	12	$5^{(5)}$ $1^{(7)}$
6	$4^{(6)}$	13	$1^{(6)}$
7	$20^{(6)}$	14	$4^{(5)}$ $24^{(6)}$

*The numeral represents the cell count and its exponent the day of the disease when the tap was done.

Of these 14 cases 50 percent had less than 10 cells in the spinal fluid and 93 percent had less than 50 cells.

The second group in our study was made up of 14 cases of mumps complicated by orchitis. In all of these the orchitis was associated with fever and frequently with severe chills. There were two types. The first, which in our series was the most common (13 cases), included those patients whose orchitis appeared after the parotid swelling. The testicular involvement was usually preceded by several days of normal temperature. A sudden elevation in temperature would occur and a painful swollen gonad appear. This took place most often on the 8th day but was also seen on the 2d to 5th day of the disease. The second type was admitted with the orchitis appearing simultaneously with the parotitis. The fever, in the one case encountered, lasted 9 days. This does not represent a complete picture of orchitis in mumps, for we did not observe any case where the orchitis preceded the parotid swelling or where the orchitis was present without parotitis.

Chart 2 is typical of orchitis appearing after the parotid swelling.

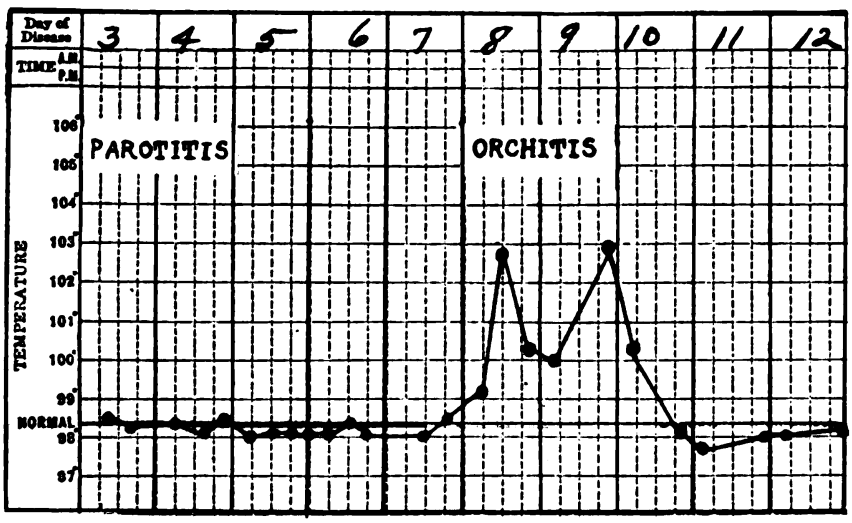


Chart 2.—Patient 84. Orchitis following parotitis.

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Chart 3 is typical of orchitis appearing simultaneously with the parotid swelling.

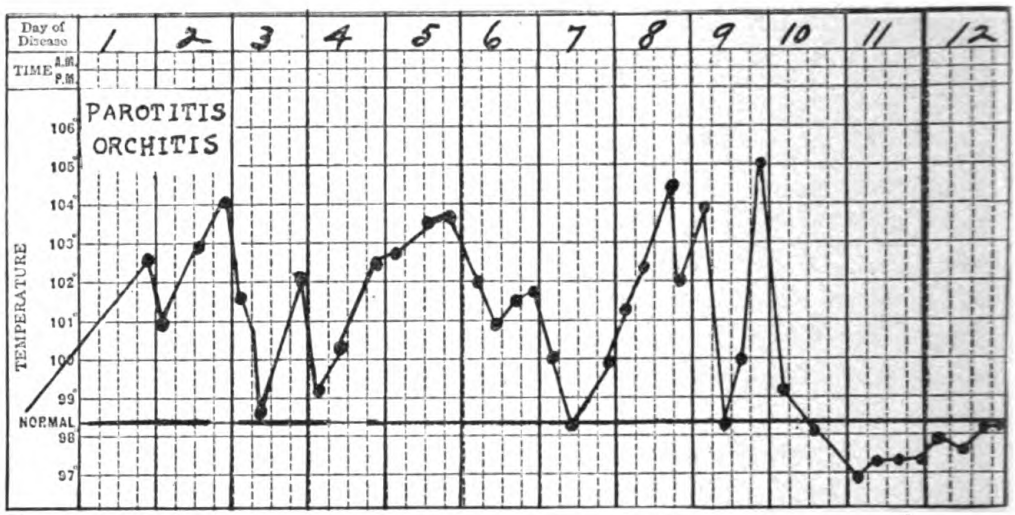


Chart 3.—Patient 85. Orchitis appearing simultaneously with parotitis.

Table 2 is a résumé of our findings on cell counts of spinal taps done on patients with orchitis as a complication of mumps.

TABLE 2.—*Orchitis complicating mumps*

Case number	Cell count spinal fluid*	Case number	Cell count spinal fluid*
60	$62^{(1)}$ $150^{(3)}$	81	$4^{(7)}$ $14^{(9)}$
61	$7^{(8)}$ $413^{(11)}$	82	$20^{(6)}$
62	$150^{(3)}$ $5^{(17)}$	83	$20^{(3)}$ $44^{(11)}$ $30^{(16)}$
63	$78^{(3)}$ $9^{(10)}$	84	$8^{(4)}$ $44^{(6)}$ $36^{(9)}$
64	$46^{(1)}$ $4^{(6)}$	85	$4^{(7)}$ $10^{(9)}$ $14^{(11)}$
65	$150^{(1)}$ $10^{(6)}$	86	$7^{(4)}$ $10^{(6)}$
80	$10^{(2)}$ $42^{(13)}$	87	$4^{(3)}$ $12^{(6)}$

*The numeral represents the cell count and its exponent the day of the disease when the tap was done.

Of these 14 cases, 100 percent had 10 or more cells in the spinal fluid; 64 percent had 40 cells and over; 28 percent had 150 cells and over. No patient with orchitis complained of headache.

In our final group, we have placed all those patients whom we classified as having meningitis either of the typical or atypical class. Regarding the typical group, there can be no controversy as to diagnosis, for they present the classical symptoms and signs of meningitis; headache, stiff neck, fever, and high cell count in the cerebrospinal fluid. We observed three such patients (chart 4).

In the atypical group (7 cases) we noted two forms. The first which has been well described by Finkelstein (*13*) showed no clinical signs of meningitis but merely a sudden elevation of temperature,

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appearing after an afebrile period and associated with an increase in the cellular contents of the spinal fluid. We encountered three such patients (chart 5). In 1919 Macleod (*14*) studied 694 cases of mumps and recorded no cases of meningitis. However, he noted that in 48 cases the temperature rose suddenly on the 7th to 10th day with no evident local manifestation. It may well have been that these 48 patients had the type of meningitis described by Finkelstein.

It is our opinion that in the atypical group there is a second form which is not well recognized clinically. It is characterized by a low-grade fever beginning often on the 7th day and continuing through the 10th day. Four such cases were present in our series. We arrived at this conclusion because we have assumed that, in the ordinary course of parotitis, a patient who is admitted with fever, shows that fever to become normal after several days; and therefore, any elevation of temperature after an afebrile period, connotes the presence of a complicating factor. Thus we consider patient 23 (chart 6) to be characteristic of this group. It can be seen that on the 3d day after admission the temperature returned to normal and remained so until the 6th day, when it began to show a mild elevation, until the 10th day when it reverted to normal. This man showed 36 cells in the spinal fluid.

Two cases of meningitis complicating mumps appeared simultaneously with the parotid swelling. Eight occurred after the parotitis. All were febrile. Six of the ten complained of severe headache. Two had nuchal rigidity.

Chart 4 is a case of typical meningitis complicating mumps.

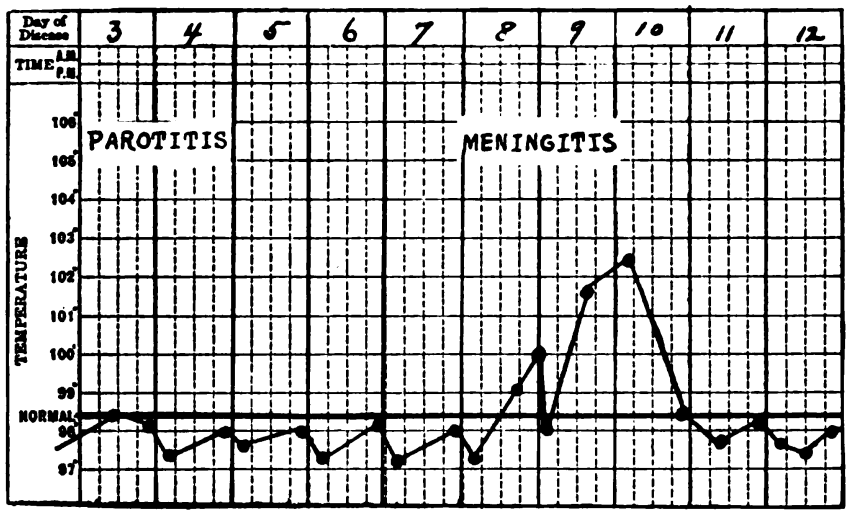


Chart 4.—Patient 40. Typical meningitis complicating mumps.

Chart 5 is an atypical form of meningitis complicating mumps, similar to those described by Finkelstein.

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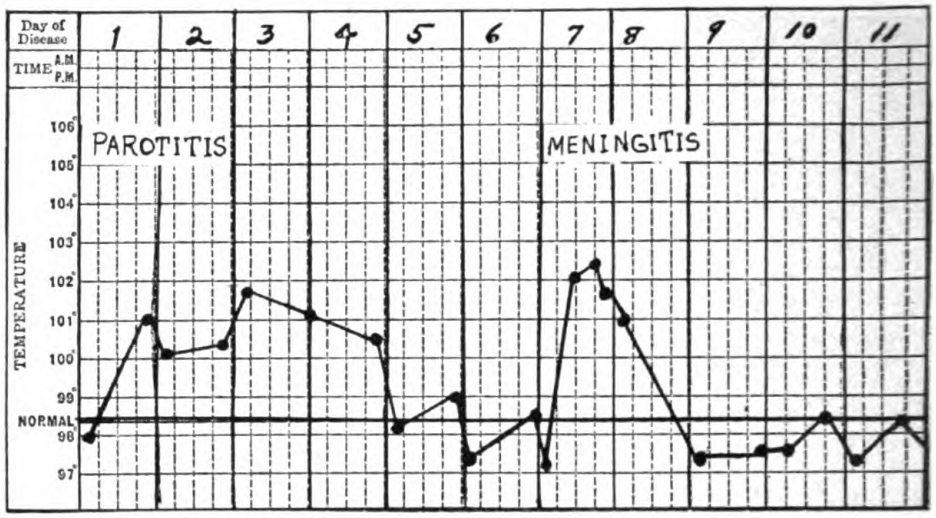


Chart 5.—Patient 22. Atypical meningitis complicating mumps.

Chart 6 is an atypical form of meningitis complicating mumps, which is not well known clinically. The dominant feature is a low-grade temperature following an afebrile period. We observed 4 cases of this. Two of these had severe headache. Two had none.

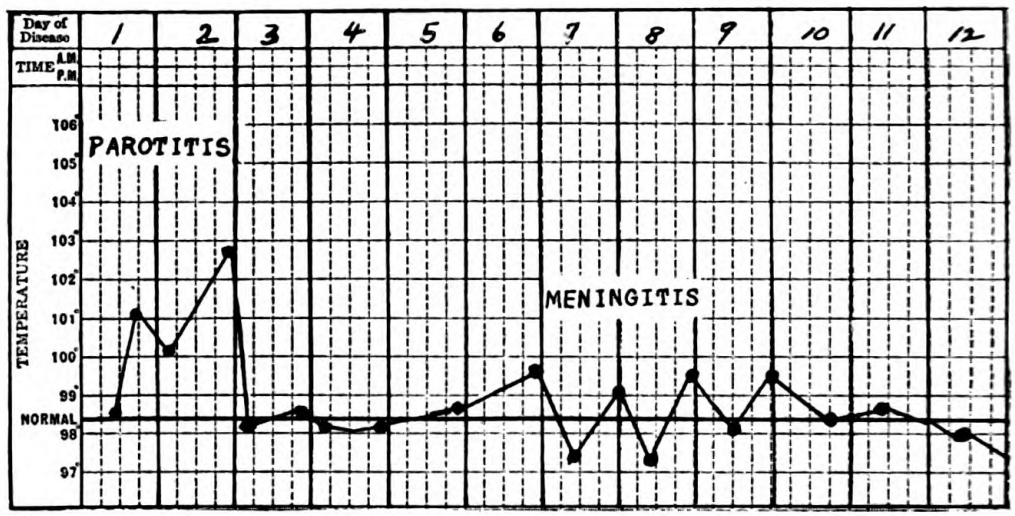


Chart 6.—Patient 23. Atypical meningitis complicating mumps.

Table 3 is a résumé of our findings on cell counts of spinal taps done on patients with mumps meningitis.

TABLE 3.—*Clinical meningitis complicating mumps*

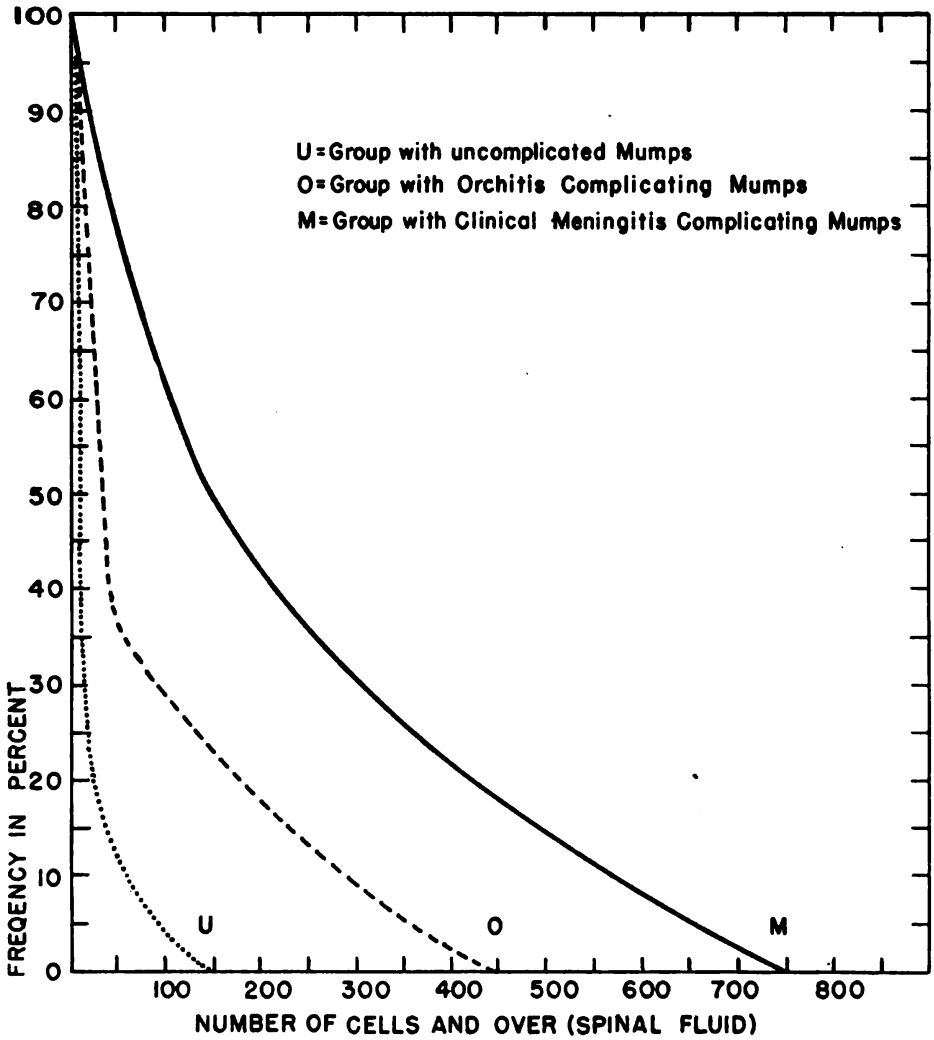
Case number	Cell count spinal fluid*	Case number	Cell count spinal fluid*
20	$5^{(5)}$ $20^{(11)}$	40	$330^{(5)}$
21	$5^{(5)}$ $150^{(8)}$	41	$180^{(4)}$
22	$720^{(8)}$	42	$51^{(4)}$
23	$36^{(8)}$	43	$11^{(7)}$ $65^{(9)}$
24	$54^{(5)}$	44	$3^{(4)}$ $533^{(9)}$

*The numeral represents the cell count and its exponent the day of the disease when the tap was done.

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Of these mumps meningitis patients, 100 percent had cell counts of 20 and over; 80 percent had counts of 50 and over; 50 percent had counts of 150 and over.

Graph 1 is arranged to summarize all of our findings on cell count of the spinal fluid, which were tabulated as an "and over" ogive after



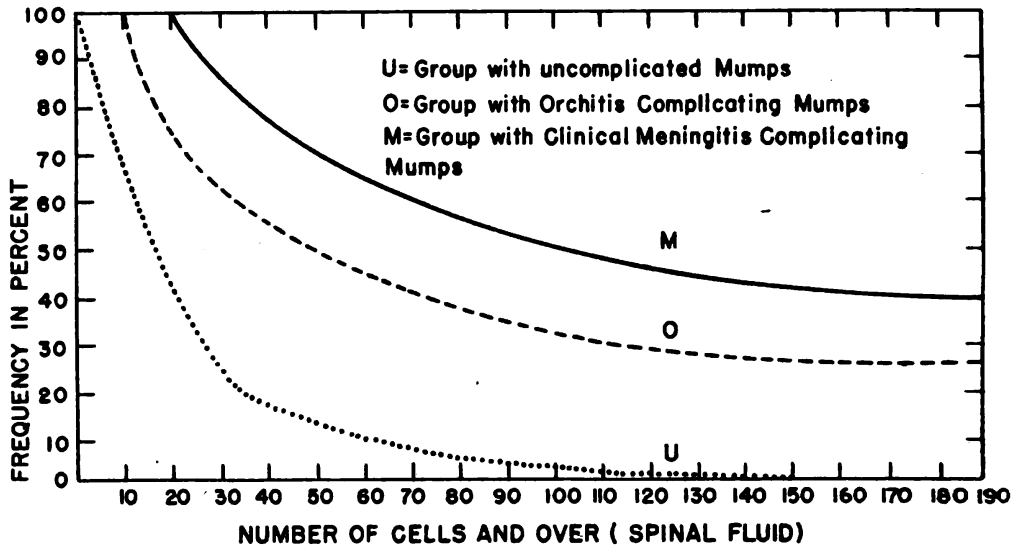
Graph 1.—Since the graph is a picture of a cumulative series, it is seen that on curve M, 80 percent of meningitis cases had 50 cells and over in the spinal fluid; 50 percent had 150 cells and over; etc.

each group was rearranged on a percentage basis in classes of 50 cells and over.

Graph 2 is drawn from all of our findings on cell counts of the spinal fluid, which were tabulated and arranged in percent, but in classes of 10 cells, in order to portray the dispersion of the lower values in our series.

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Graph 2.—Since the graph is a picture of a cumulative series, it is seen that on curve O, 100 percent of the orchitis cases had 10 cells and over; 64 percent had 40 cells and over; etc.

It can readily be seen that the cellular reaction is most marked in the meningitis group, less in the orchitis group, and least in the uncomplicated group.

DISCUSSION

The normal spinal fluid contains 0 to 10 cells. No author considers anything above 10 as normal (*15*) (*16*). Some consider 10 cells abnormal (*17*) (*18*). Thus the finding of more than 10 cells in the spinal fluid represents a pathologic process. In a disease in which typical meningitis is not an unusual complication, the mere finding of a pleocytosis in the spinal fluid, whether or not it is accompanied by signs or symptoms must be considered likewise as a meningitis in the same sense that an increased number of cells in the spinal fluid during the course of an epidemic of anterior poliomyelitis is often considered as a form fruste or an abortive form of the disease. From this standpoint, 30 of our 38 patients (79 percent) had meningitis. Of the other 8, 7 belonged to group I (uncomplicated mumps). It may, however, be that more frequent taps in this last group would have shown a cell count greater than normal to occur even more frequently.

As previously pointed out, 2 of our cases of meningitis appeared simultaneously with the parotid swelling and 8 appeared after the parotitis. However, mumps meningitis may precede the parotid swelling. It may occur without the parotid swelling. It may occur without the parotid swelling and be followed by orchitis (*19*). Under such conditions, the diagnosis of mumps meningitis presents some difficulty.

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In 1904 Dopter (*20*) wrote that in mumps one must consider that the virus is localized in the meninges rather than regard it as a complication. Recent research seems to indicate that the virus is always present in the spinal fluid (*21*). Of the central nervous system involvement in the disease, the following have been noted in the literature: (1) Meningitis; (2) meningo-encephalitis; (3) meningo-radiculitis; and even (4) meningo-myelitis. It is often difficult clinically to differentiate in these cases between pure meningitis and meningo-encephalitis. None of our patients seemed to show evidence of involvement of the encephalon. There is apparently no relationship between the severity of symptoms and the number of cells in the spinal fluid. It has been shown that the lymphocytosis of the spinal fluid may last 30, often 50 and rarely 60 days (*11*). The appearance of clinically recognizable involvement of the central nervous system varies from outbreak to outbreak. It has been suggested, but not sufficiently corroborated, that minor mental changes may occur following mumps meningo-encephalitis (*22*). The erythrocyte sedimentation rate in mumps meningitis shows no significant deviation from the normal (*1*).

CONCLUSIONS

1. Thirty-eight cases of mumps were studied intensively.
2. A pleocytosis of the spinal fluid should be considered as evidence of the presence of a meningitis, with or without the presence of clinical manifestations.
3. Seventy-nine percent of the patients had meningitis on the basis of an increased number of cells in the spinal fluid.
4. Fifty-three percent of the patients had subclinical meningitis.
5. Twenty-six percent of the patients had clinical meningitis.
6. Clinical meningitis is made up apparently of two forms, typical and atypical.
7. Another subgroup of the atypical form is described.

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FIRST-AID AND WOUND INFECTION

In wounds which had been "cleaned" and dressed, all infections were more frequent than in those which had only been dressed.

Immediately after injury, droplet infection from those who have tended the wound may be responsible for subsequent sepsis, and in the teaching of first-aid the danger of such infection should be stressed. Wounds which had been covered at an early stage with a sterile dressing arrived in hospital in the least infected state, whereas wounds treated with unsterilized domestic dressings, especially soiled handkerchiefs, were the most contaminated.

First-aid "cleaning" of wounds is to be deprecated. Thus, when this was done, more than twice as many infections by hemolytic streptococci occurred than when the wound was simply dressed without attempt to "clean" it.—DE WAAL, H. L.: Wound infection; preliminary note on combined clinical and bacteriological investigation of 708 pounds. Edinburgh M. J. 50: 582–583, October 1943.

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POOLED PLASMA TREATMENT OF MUMPS ORCHITIS

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Lieutenant Commander (MC) U. S. N. R.

A large percentage of young men of military age are subject to mumps. An epidemic of this disease may result in serious loss of man-hours in Navy personnel. Since approximately 18 percent of all male adults with mumps develop orchitis as a complication, the number of sick days is greatly increased. Fifty percent or more of those with orchitis develop atrophy of the involved tissue and may be rendered permanently sterile.

The purpose of this article is to call attention to the fact that there exists a form of treatment for mumps and its complications that is not generally appreciated.

In 1915 Hess (*1*) first noted that convalescent serum was of value in the prophylaxis and treatment of mumps. Since then serum has been used by several investigators with varying results. Most of the work has been in the nature of preventing the disease, or of preventing complications, and since the quantities of serum used ranged between 2 cc. and 40 cc., results in general are inconclusive.

Bailey and Haerem (*2*) employed 10 to 20 cc. of convalescent serum per patient in an epidemic of mumps at Fort Sill. Of 551 patients who did not receive the serum, 110, or 19.9 percent, developed orchitis, while 28 or 15.3 percent of 183 who did receive the serum developed this complication. Iverson's (*3*) series showed a 20-percent incidence of orchitis in serum-treated individuals as compared to 24 percent in those untreated. In contrast to this, Vezeaux de Lavergne and Florentin (*4*) treated 113 patients with a total of 30 cc. of serum and reduced orchitis from 24 percent in their untreated cases to 4 percent in their treated ones. Beckman believes that serum does not alter the general course of the disease but does seem to lessen the incidence of orchitis. Cecil agrees that the incidence of orchitis is decreased by its use.

The literature on treatment of mumps orchitis with serum is scanty. Levinson and Wolf (*5*) believe the serum to be of value therapeutically although they state that their experience is limited. Thalhimer (*6*) advises the use of 40 to 60 cc. of serum to alleviate the symptoms of orchitis. Probably the best description of the results to be obtained are found in the study of Gradwohl and his coworkers (*7*); in 2 of

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their cases treated with convalescent serum a rapid drop in temperature and subsidence of symptoms occurred.

While convalescent serum as such may be difficult or impossible to obtain, every medical activity in the Navy is equipped with plasma. Although the greatest amount of antiserum is presumably present in blood collected within 6 months after recovery from the disease, the fact that one attack of mumps usually confers immunity for life may account for normal pooled plasma containing antiserum in useful quantities. Since most plasma is obtained in larger cities, it should contain a certain amount of mumps antiserum, as most cases of mumps occur in urban areas. A number of cases of mumps orchitis in adolescent boys have been treated in this manner with good results, but records on these cases are not presently available. However, the two following cases treated aboard ship are appended.

CASE REPORTS

Case 1.—A young man, 19 years of age, developed orchitis involving the left testicle on the 5th day after onset of mumps. At that time his temperature was 104° F. The temperature fluctuated between 101° and 103° F. for the next three days and the testicle increased in size. On the 8th day the patient had a chill with a subsequent fever of 105° F. at which time the right testicle became grossly swollen and tender. One unit (250 cc.) of plasma was administered intravenously. In 2 hours the temperature had dropped to 102° F. and in 8 hours it was normal and remained so. The left testicle which was originally involved became atrophic, but the pain and swelling in the right testicle subsided within 24 hours.

Case 2.—The patient, 21 years of age, ill with mumps, developed unilateral orchitis on the 4th day of the disease, with a temperature of 104° F. He was immediately given 1 unit of plasma intravenously, and within 24 hours his temperature had dropped to normal, with a rapid subsidence of the pain and swelling. There were no further sequelae.

While two cases are not a significant number, the dramatic response to plasma therapy offers evidence that this method deserves further trial and investigation. Gordon and Heeren (*8*) state that the value of this type of treatment comes from immunotransfusion of large amounts of blood. It appears, however, that one unit of pooled plasma contained the amount needed. It is apparent that the antiserum content of different batches of plasma will vary greatly.

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BLOOD PRESSURE AND THE OPERATING TABLE

The position of the patient on the operating table affects the blood pressure. When the bridge of the operating table is raised for gall-bladder and kidney procedures a steady fall in pressure ensues, but with the lowering of the bridge the blood pressure recovers. This bridge is painful to patients: pneumatic pillows are more comfortable. Sudden changes from the Trendelenburg to the horizontal position also cause falls in pressure; lifting from the table to the ambulance and thence to the bed is also associated with a fall, which is considerable and recovers but slowly after major procedures.—DODD, H.: Significance of blood-pressure readings in general surgical work; with special reference to cardiac index. Brit. M. J. 2: 811–813, December 25, 1943.

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INDICATIONS FOR AND CONTRAINDICATIONS TO TRANSFUSIONS

There are as many tables of indications and contraindications to the transfusion of blood as there are investigators. Briefly, the indications may be classified as follows: To increase the blood volume, oxygen carrying power of the blood, concentration of protein, coagulability of the blood, and immunity of patients in certain conditions.

The contraindications to blood transfusions fortunately are relatively few. It might be said that if a transfusion is especially indicated, it should be performed with extra caution, in spite of the possible presence of a condition which otherwise would be a contraindication to a transfusion. However, acute pulmonary edema, cardiac decompensation and massive pulmonary embolism are said to be absolute contraindications. Especial care must be exercised in cases in which there have been previous severe reactions following blood transfusions. This is also true in cases of severe renal damage.—SELDON, T. H.; LUNDY, J. S.; and ADAMS, R. C.: Transfusions of blood and plasma. Anesthesiology 5: 22–23, January 1944.

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SPORADIC MENINGOCOCCUS MENINGITIS

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Commander (MC) U. S. N., Retired
THORNTON SCOTT
Lieutenant (MC) U. S. N. R.
and
DR. HERMAN C. MASON[1]

An aviation cadet was admitted to the sick list complaining of fever, headache, and general malaise. He rapidly developed a stiff neck and a widespread hemorrhagic macular rash with large areas of ecchymosis which were not present on admission, and he soon became semicomatose. Lumbar puncture yielded a purulent fluid in which gram-negative intracellular diplococci were found. Blood culture was negative. Treatment with intravenous sodium sulfapyridine was instituted and he made an uneventful recovery without sequelae.

A second cadet was admitted on the same day with fever, malaise, and painful swelling of many joints. He showed an identical rash on entry which increased markedly in extent and severity during the day. He had no headache or stiff neck. Blood culture was negative. Nevertheless it was considered that the patient was suffering from the septicemic phase of meningococcus infection and he was given sulfapyridine by mouth, two doses of 4 gm. at a 4-hour interval and then 1 gm. every 4 hours. He improved gradually. Low-grade fever with some residual pain and swelling of several joints persisted for 2 weeks after chemotherapy was discontinued. Lumbar puncture was deemed inadvisable. He did not develop signs of meningeal involvement at any time and made a complete recovery.

On the following day a third cadet was admitted to the hospital with the complaint of fever, sore throat, headache, generalized aching, and malaise. Early the following morning a widespread hemorrhagic and ecchymotic rash appeared and the patient was deeply comatose; he could not be aroused. His neck was rigid; his pulse was not perceptible at the wrist, and he appeared moribund. Intravenous sodium sulfapyridine was administered immediately, 50 cc. of 5-percent solution in distilled water, and this dose was repeated in 4 hours. There was definite improvement after the first dose, and after the second dose the patient was awake and able to take sulfapyridine by mouth.

[1] Department of Bacteriology, School of Medicine, University of North Carolina.

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Twelve hours after instituting parenteral treatment he was able to converse fairly rationally and asked for something to eat.

He made an uneventful recovery impeded only by the breaking down and slow healing of some of his extremely severe skin lesions. Lumbar puncture was not done because of his apparently terminal condition, the diagnosis being obvious. These three cadets were eventually returned to the full flight program in excellent health and without residual involvement of any kind apparent.

PROPHYLAXIS AND EPIDEMIOLOGY

Since acute upper respiratory infections were very common, sulfathiazole was given to the whole command in an effort to prevent the development of further cases of meningitis. Little could be found in available literature to warrant this procedure. However, having observed the successful prevention of neisserian infection in 1,500 cases by giving 2 gm. of sulfathiazole as venereal prophylaxis within 8 hours after exposure, it was decided to apply this method in the present urgent situation, on the basis that there is a close relationship between the two diplococci. Weather conditions were very inclement and cold at this time, and the cadets were following a rigorous and fatiguing program, a good part of which was carried on without shelter from the elements. No untoward reactions from chemotherapy were noted.

Sulfathiazole in 2-gm. doses was given at the midday and evening meals and at the midday meal on the following day, a total of 6 gm. per person. Medical details inspected each man in the sickbay at regular intervals. Any symptoms of illness in the command were reported at all hours of the day or night because of the prevalence of catarrhal fever and pneumonitis, with possible masking of meningitis.

To avoid interfering with the training program, two cadets who had been in close contact with the first patient cited and who had shown the presence of intranasal phagocyted gram-negative diplococci before nasopharyngeal cultures could be carried out, were immediately isolated and treated prophylactically.

With the arrival of an epidemiologic unit which had been requested, nasopharyngeal cultures were made on all individuals in the three platoons to which the three patients belonged. Cultures were plated on veal infusion chocolate agar and incubated in approximately 10–15 percent CO_2.

Suspected colonies of bacteria oxydase-positive to p-aminodimethylaniline monohydrochloride and exhibiting gram-negative diplococci were retransferred and inoculated into sugars (Difco). Contacts of all three fulminating cases from the three platoons were isolated, as well as those showing suspected positive cultures. One such culture was definitely proved to be a characteristic type IIa meningo-

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coccus on the basis of fermentation tests and by typing microscopically with monovalent antisera (Gilliland).[2] Horse serum and saline controls were negative.

Treatment of contacts and the positive carrier was by administration of sulfathiazole in 2-gm. doses twice a day for 3 days. The contacts and positive carrier were recultured and found negative within 7 days after treatment was started. One of the group IIa strains showed low agglutinin relation to group I typing serum. This was detected by microscopic agglutination.

The second carrier survey made 14 days later revealed the presence of 3 carriers of type IIa meningococci. Treatment with sulfathiazole was begun by oral route (4 gm. in 24 hours). These carriers were permitted to attend classes but were not allowed participation in sports. It was learned that these individuals had been directly in front, to the side, and rear, respectively, of one of the patients with a fulminating case during the usual marching exercises and hikes. No relationship could be established between the two other fulminating cases. Two of the carriers were found negative by culture within 3 days and the third carrier within a week after beginning prophylactic treatment.

No further cases of meningitis occurred on the reservation following the release of the convalescents and the carriers.

In 1942 Branham and Carlin (*1*) reported a newly recognized group of meningococci. The heterogenicity of group II meningococci strains has been noted by others for some time. Cohen (*2*) placed the encapsulated strains with the atypical meningococci, but also stated that 25 percent of the group II meningococci fell into the encapsulated group. Positive Neufeld reactions have been observed in some IIa strains with properly prepared monovalent sera, while regular group II strains have not been found to show this reaction. This was also observed by Lewis and Dingle (*3*) during the Halifax epidemic. Those who have worked with individual strains find that many of them give a definite Neufeld reaction. Branham has shown that group IIa strains are related to group II by agglutination, but that there also exists a very slight agglutinin relation to group I strains.

Group II strains have been commonly found in sporadic cases and in chronic carriers, and while types II, IIa, and IV are not usually found in epidemics, the incidence of type II strains, according to Branham, increased from 9 percent in 1936 to 55 percent in 1939. The incidence of carriers compared with an expected carrier rate in infected and noninfected groups is of some interest. The study by Mathers

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[2] Acknowledgment is made to Lieutenant H. Gezon and the Norfolk Epidemiological Unit for assistance in typing the culture.

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and Herrold (*4*) indicated that in a large sampling over 4 percent would be carriers, and of these, 1 or 2 percent would be chronic carriers in noninfected groups.

Four carriers were found by our 2 surveys in the three platoons composed of 226 men; one was detected in the first cultural survey, and 3 in the second. The first carrier survey included the several direct contacts who were given immediate prophylaxis before the survey was done. This may account somewhat for the low figure in the first survey.

Since the carrier rate may exceed 36.7 percent it is surprising that the rate was roughly 2 percent here as detected by carrier examination under better than routine conditions. However, the first carrier rate may have been influenced by the prophylactic administration of sulfathiazole to every person in the command. The necessity for instituting immediate preventive measures without waiting for cultures is best explained by the presence of 3 fulminating cases occurring at almost the same time and between which there was no known contact.

Reculture 14 days later demonstrated that the low carrier rate on the first culture survey was not attributable merely to temporary failure of the organisms to grow because of recent chemotherapy. More study over a longer period is necessary before the effect of the sulfonamides on chronic carriers of meningococci can definitely be stated.

Rake (*5*) (*6*) has stated that the group I carrier state is an actual infection often limited to the nasopharynx, and that group II organisms may be passive saprophytes without potential invasiveness. Silverthorne and his coworkers (*7*), on the other hand, have shown that group II carrier strains isolated during outbursts of group II cases are virulent. In Rake's experience carrier strains of any type possess lower virulence than case strains of the same type.

It may be of epidemiologic interest to record that a young child of an enlisted man who lived out of the reservation but in the town died of type IIa meningococcus meningitis, isolated at autopsy. Evidently sporadic carrier strains are more virulent than is recognized, since the case occurred 2 weeks after the three fulminating cases, and no relationship to carriers or cases could be established.

SUMMARY

Three fulminating cases of meningococcus meningitis occurred almost simultaneously at a Navy preflight school. All three patients recovered without residual infection after prompt treatment with sodium sulfapyridine, and were returned to full duty as aviation cadets.

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The three cases of meningitis occurred within a 24-hour period, in separate platoons, and could not be shown to be epidemiologically related.

Prophylaxis was attempted by the oral administration of sulfathiazole to the entire preflight command. A total of 6 gm. per person was given. Contacts were isolated and given 4 gm. of sulfathiazole per day.

The first carrier survey after prophylaxis revealed one carrier of type IIa meningococcus. Fourteen days later the second carrier survey disclosed three carriers of type IIa meningococci. These three carriers had marched directly in front, to the side, and rear, respectively, of the cadet with the third fulminating case reported.

No other cases of meningitis occurred.

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TREATMENT OF BURSITIS

Of 50 cases of bursitis of various types involving the olecranon, prepatellar and popliteal bursae, chemical obliteration treatment was used in 27 cases presenting chronic effusion. Other appropriate methods of treatment were used in the remaining cases. In 27 cases treated by chemical obliteration in which a special type of rubber drain was used, 25 have apparently been cured. The number of required office visits is minimal and loss of time from work is short. The use of an indwelling specially devised rubber drain after injection of the irritant appears to reduce the necessity of reaspirations, shortens treatment time and results in a satisfactory number of cures.—COTTRELL, J. C.: Conservative treatment of chronic bursitis; by injection of sclerotic agents combined with drainage. J. A. M. A. 124: 81-83, January 8, 1944.

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THE PREVENTION OF CHRONIC EMPYEMA

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Despite the great progress in chest surgery since the last war, when Graham and his coworkers established some fundamental principles of thoracic physiology, confusion still exists in the management of pleural exudates of nontuberculous origin. Although some form of pleural drainage is generally agreed upon, the indications for thoracentesis, closed or open drainage are still the subject of considerable controversy.

Considering a pleural empyema as a dynamic process going through various phases, it will be realized that each type of drainage has its proper place in the management of the phases encountered. Certain basic concepts of thoracic physiology as related to the changes in intrapleural pressures, lung compression, mediastinal displacement, and the resultant effect on the vital capacity must be kept in mind. All of these factors are involved in the dynamic process initiated by the formation of a pleural exudate.

The initial phase of an acute empyema is characterized by a generalized pleural inflammation and the formation of the usual inflammatory exudate. The amount and character of the exudate is variable, depending chiefly on the offending organism and the severity of the infection. Streptococcal exudate is usually more rapid in its formation and greater in amount than that of the other common pyogens. In each case, however, the severity of the resulting respiratory distress is dependent upon several factors, such as the extent of any coexisting parenchymal disease, the rapidity and amount of fluid formed, and the extent of mediastinal displacement. These lead to alteration in the vital capacity, the fundamental consideration in any respiratory infection.

Although the amount of fluid may obscure any underlying parenchymal involvement, physical signs and x-rays will always reveal the extent of mediastinal displacement. If a patient exhibits only mild dyspnea and there is no evidence of massive fluid formation, a chest aspiration is not indicated. It should be kept in mind, however, that a thoracentesis in a patient who is dyspneic and coughing is a hazardous procedure. It is practically impossible to insert a needle into the thin layer of fluid without tearing through the visceral pleura and under-

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lying infected lung. A simple effusion may easily be converted into a frank empyema by such manipulation. It is far safer to defer even a diagnostic aspiration until the patient has recovered from the initial shock of pleural irritation. The administration of oxygen, chemotherapy, sedation, and other supportive measures will tide the patient over this early phase; moreover in a number of instances the process may be terminated in this stage and the pleural exudate will be completely absorbed.

Frequent examination and fluoroscopic study enable the physician to follow the progress of the exudate. Thoracentesis is indicated when the fluid is massive enough to hamper the inflation of the opposite lung as evidenced by the extent of mediastinal displacement and the marked respiratory distress. It is also indicated in the presence of pronounced dyspnea without mediastinal displacement. These cases usually show signs of parenchymal involvement in one or both lungs which further reduces the pulmonary reserve. Finally, a diagnostic aspiration should be performed for any pleural exudate which persists for several weeks in spite of the absence of any respiratory difficulty or temperature elevation.

Before aspiration, the patient should be given adequate sedation and instructed not to cough or breathe deeply. The use of a small syringe (2–cc.) and a 16-gage needle permit careful penetration through the soft tissues and the parietal pleura. Larger syringes and smaller gage needles impair the tactile sense and may fail to obtain fluid.

Any form of open drainage is contraindicated in the early phase of fluid formation, since the creation of an open pneumothorax at a time when the pulmonary reserve is so low may easily prove disastrous.

With each needle aspiration, the change in the gross character of the fluid is carefully noted. Once frank pus is obtained, adequate drainage is indicated. As a rule the presence of pus signifies a localized infection, a fairly stable mediastinum and an adherent lung. In addition the pulmonary infection will also have subsided sufficiently to restore pulmonary reserve, thus improving the vital capacity. The aim in treatment in this phase is to secure adequate dependent drainage of the localized pleural abscess.

Open thoracostomy by rib resection after accurate x-ray and fluoroscopic localization is the procedure of choice. This method enables the operator to ascertain definitely the most dependent part of the cavity. However, an attempt to establish drainage immediately overlying the diaphragm should be avoided because the subsequent rise of this structure will obstruct drainage. In any case, the drainage site should never be more than one rib above the bottom of the fluid pocket. A higher location is inadequate; this error alone accounts for a large number of chronic empyema cases.

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A closed intercostal catheter drainage is not very efficient in these cases for several reasons: (1) One is not absolutely certain of dependent drainage; (2) the trocar-catheter method is a relatively blind procedure and may cause damage to the underlying adherent lung; (3) obstruction of the tube occurs frequently and drainage is prolonged, thus increasing the likelihood of dealing with a chronic phase.

Instead of becoming merely a localized pleural abscess, an empyema may progress until the entire pleural space becomes filled with exudate. The lung is then compressed against the mediastinum and embarrasses the free action of the opposite lung. The vital capacity becomes greatly reduced, dyspnea is marked, and cyanosis is usually present. Open drainage in these desperately ill patients is absolutely contraindicated. The creation of an open pneumothorax at a time when the vital capacity closely approaches the ordinary tidal air requirements may prove fatal.

The safest treatment under the circumstances is the employment of repeated needle aspirations several times daily. The frequency of aspiration is determined by the rate of reaccumulation of fluid as evidenced by the return of severe respiratory distress. Care must be exercised in avoiding a pulmonary edema initiated by the removal of too large a quantity of fluid at a single aspiration. High negative pleural pressures and rapid lung re-expansion favor the development of pulmonary edema. Though no set amount can be formulated for every case, it is undoubtedly safer not to exceed 500 to 600 cc. at each aspiration.

If the character of the pus does not permit satisfactory needle aspiration, an airtight intercostal catheter drain should be employed. The tube should be immediately connected to a water-sealed drain. Here again intermittent drainage is advisable to prevent too rapid changes in intrathoracic pressures. Whenever the tube becomes occluded, syringe irrigation with normal saline is employed. Caution must be exercised not to permit air to enter the chest during the temporary break in the closed system. As the pleural exudate is evacuated, pressure on the mediastinum and opposite lung is relieved and vital capacity is improved. After mediastinal stabilization has taken place and the general condition of the patient warrants it, more accurate drainage by rib resection may be instituted. It will usually be noted that closed drainage has, by this time, lost much of its efficiency, that it is no longer an airtight system and functions for the most part as a poorly operating open type.

Intercostal catheter drainage is useful in the very young and the elderly patients. It permits sufficient drainage while intrathoracic stabilization and general improvement take place. There is no doubt that accurately placed intercostal tubes, especially when combined

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with tidal irrigation, have cured many empyemas. The disadvantage is, however, that such an apparatus requires almost constant supervision. Even in a hospital handling many cases with trained personnel it is not uncommon to discover a poorly functioning closed system. Therefore such a method can never be too practical in the average hospital and perhaps less so in the exigencies of the present conflict.

The presence of a foul pus on aspiration reveals probably the most dangerous type of acute empyema which may be encountered in the badly contaminated, penetrating war injuries. These anaerobic infections are usually associated with a bronchopleural fistula and the patient coughs up copious foul purulent sputum. Immediate drainage is indicated, preferably an open rib resection. If, however, the intrathoracic conditions demand a closed drainage, it is not performed by the trocar method because of the great danger of initiating a fulminating cellulitis of the chest wall. Instead the pleura is approached by careful incision and is opened under direct vision. A large soft rubber tube is then inserted and anchored to the pleural edges with a heavy suture material. The wound around the tube is left open and packed with zinc peroxide. Since these patients are gravely ill, all supportive measures should be carried out, including the administration of gas-gangrene antitoxin. The sooner an open thoracostomy can be safely done, the more rapidly will the anaerobic infection clear up.

In any empyema, once adequate drainage has been established, the phase of lung re-expansion begins. This period demands careful observation. The rate of re-expansion varies in each case, but in all it should be progressive. The use of irritant antiseptic solutions which attempt to sterilize the cavity or to dissolve the exudate adherent to the pleural surfaces may do more harm than good. After a few days postoperatively and in the absence of bronchopleural fistula, gentle irrigation with normal saline may be carried out daily. The essential requirement is that the thoracostomy be kept patent until the lung has fully re-expanded, and the pleural space has been obliterated. In the open thoracostomy, the drainage tube should be very soft, of large caliber and firmly anchored to the skin margins with heavy silk. Large safety pins will also prevent these tubes from slipping into the pleural cavity. Under no condition should drainage tubes be removed until actual measurement of the residual pleural space reveals a capacity of 10 cc. or less. Introduction of a contrast substance and x-ray studies will also aid in determining the extent of the residual space. During this phase, lung re-expansion will be accelerated if the patient is ambulatory and practices deep breathing and coughing exercises at regular intervals.

The injudicious early removal of tubes simply because drainage is slight or absent in the presence of a residual cavity accounts for an-

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other large group of chronic empyemas. These cases demand immediate and careful investigation. X-ray studies may reveal a foreign body or some isolated undrained pus pocket.

Failure to discover either condition should arouse the suspicion of a probable bronchopleural fistula and perhaps a tuberculous mixed infection. Expectoration of a dye such as methylene blue previously instilled into the pleural space is conclusive evidence of a patent fistula. A coughing spasm initiated almost immediately after the introduction of a small amount of irrigating fluid is strongly suggestive of a fistula. Under these circumstances, all lavage must be stopped. Although the majority of such fistulas of nontuberculous origin heal spontaneously as lung re-expansion proceeds, consultation with a thoracic surgeon is advisable. Early consultation is advisable in any case where for any reason lung re-expansion fails to progress satisfactorily. This precaution would, in many instances, prevent an empyema from passing into a chronic stage, which in most instances requires radical surgery to effect a cure.

CONCLUSIONS

1. Chronic nontuberculous empyema is a preventable complication.
2. Thoracentesis, closed catheter drainage, and open thoracostomy each has its definite place in the management of the various phases in the development of acute empyema.
3. Adequate dependent drainage must be established.
4. Emergency drainage is indicated in the anaerobic mixed infections.
5. Careful management of the phase of lung re-expansion is required, especially guarding against too early removal of tubes.
6. The reason for failure of progressive lung re-expansion in an adequately drained case must be ascertained. The chief causes are foreign bodies, isolated pus pockets, and unsuspected tuberculous infection.
7. Early consultation is advised if for any reason re-expansion appears delayed or reaches a standstill.



WARD INFECTION

Other organisms commonly found in the air do not have an important role in ward infection, except when dressings are carried out immediately or soon after sweeping and bed-making. A mode of infection not commonly suspected is that which occurs when air currents created by the movement of patients in bed pass from below the bed-clothes over wounds. During dressing all movement of the patient should be discouraged.—DE WAAL, H. L.: Wound infection; preliminary note on combined clinical and bacteriological investigation of 708 wounds. Edinburgh M. J. 50: 583, October 1943.

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GENERALIZED VACCINIA AND VACCINIAL REACTION

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There is much controversial literature on the subject of cutaneous reactions resulting from vaccination with cowpox virus. Paschen (*1*) classifies them as follows:

1. Eruptions due to direct infection with the vaccine virus:
   - A. Secondary vaccination (nebenpocken) near the original site from spread of the virus through the lymphatics.
   - B. Secondary accidental vaccinations at distant sites, where there has been no previous cutaneous disease.
   - C. Secondary infection on previously diseased skin (eczema vaccinatum).
2. Eruptions from hematogenous spread:
   - A. Exanthems directly following vaccination.
   - B. Postvaccinial exanthems occurring at the time of pustulation and of various types; scarlatiniform, morbilliform, multiform, urticarial or purpuric.
   - C. True generalized vaccinia in the narrow sense; hematogenous spread of the virus to skin not previously diseased.
3. Eruptions coincident with vaccination; pemphigus, scleroderma, dermatitis herpetiformis, and others.
4. Eruptions due to mixed inoculation or infection of the vaccination site; tuberculosis, syphilis, impetigo, erysipelas, etc.

Danziger (*2*) stated that cases of postvaccinial eruptions were first collected from the literature by Behrend who described erythematous, urticarial, and herpetic lesions in addition to pustular eruptions called "vaccine generalisee" by the French.

Cases of true vaccinial disease have fallen into two groups, the first corresponding to group 1C of Paschen's classification; that is, eczema vaccinatum or secondary infection on previously diseased skin. This type has occurred almost exclusively among infants and children (*3*) (*4*) (*5*) and has been given a variety of names. Kaposi described two cases in children with pre-existing eczema, of a more or less generalized eruption resembling vaccinia which he termed eczema herpetiforme and which later came to be called Kaposi's varicelliform eruption. Juliusberg described similar cases and used the term pustulosis acuta varioliformis.

In his exhaustive article Tedder (*3*) gave the following clinical résumé. The vast majority of cases occurred in infants and children with a pre-existing eczema or other dermatosis who usually had had contact with a vaccinated person. There was high fever, malaise, and

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regional lymphadenitis, rarely abscess of the nodes. Lesions appeared first as clear vesicles and later became pustular and umbilicated. The involved areas were erythematous and edematous. The lesions erupted in crops for 1 to 7 days, most of them occurring on previously inflamed skin although some appeared on clear sites. The pustules dried in from 7 to 10 days, forming crusts which fell off in about 2 weeks, leaving pigmented pitted scars.

Lesions have been observed on all parts of the body, including the eyelids, cornea, tongue, nasal septum, buccal mucosa, and genitalia. Cases also occurred in children not previously affected by eczema. Fatal outcome has occurred and was ascribed to sepsis. Accidental vaccination on the tongue has been described from licking or kissing children on or near the vaccination site. Transitory erythematous or urticarial lesions have developed 2 to 4 days after vaccination. The very rare true postvaccinial exanthems developed 7 to 9 days after vaccination.

The second group consisted of cases of true generalized vaccinia (2C of Paschen's classification); that is, vaccinia caused by the hematogenous spread of the virus from a vaccination site to skin not previously diseased. These have occurred chiefly among vaccinated adults. Two of my cases were in this group with the exception that in one patient there was a previous dermatosis. However, only a minority of lesions occurred on the already inflamed skin areas. The third case was a postvaccinial exanthem of the erythema multiforme type (2B of the classification).

It has been generally accepted that variola is a blood-borne disease. Paschen stated that this was for some time not believed to be the case for vaccinia; Gins and Kamentzewa (quoted by Tedder) proved the hematogenous spread of the cowpox virus by isolating the virus from the tonsils of six children 3 days after skin vaccination; also from the upper respiratory passages, blood, liver, and spleen of guinea pigs and rabbits 2 days after cutaneous vaccination. Paschen cited the work of many investigators who demonstrated the generalization of the vaccinia virus by positive results obtained after inoculating the blood of rabbits vaccinated by various methods (corneal, subcutaneous, intraperitoneal) into the skin of other rabbits and calves.

Paul's test is used to prove that generalized vaccinia-like lesions are caused by the cowpox virus. It consists in the inoculation of material from the human pustules into a rabbit's cornea and is positive if there is an ensuing keratitis and histologic inclusion of the virus (Paschen or Guarnieri bodies) in the corneal cells.

Concerning the immunology involved, Paschen thought that the generalized virus evoked the production of virucidal substances by the body cells, and with Groth he believed that postvaccinial exanthems, other than true generalized vaccinia, were produced by the

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union of virus and virucidal substances in the manner of allergens and their antibodies.

On the basis of this work, it seems likely that cases of generalized vaccinia which occur at the height of a positive vaccination represent the hematogenous spread of a dermatotropic virus from the original vaccination site, due either to diminished host resistance, an enhanced virus, or the combination. It cannot be denied, however, that the eruption may also be caused by a contact spread of the virus on the surface of the skin.

Whether or not the vaccinia virus is the actual cause of the cases of eczema vaccinatum in infants and children is still in dispute. Tedder believes that eczema vaccinatum and the Kaposi-Juliusberg dermatosis are identical and caused by the vaccinia virus; also, that the absence of a history of contact with an individual with an active vaccination, an important etiologic factor, is due to a poor or unelicited history. Ellis (*4*) likewise believes that eczema vaccinatum is due to the vaccinia virus. Ronchese (*5*) believes both eczema vaccinatum and generalized vaccinia are due to the cowpox virus, that the former is caused by surface spread and the latter by hematogenous mechanism.

The generally accepted criteria for diagnosis and identity of the two types are:

1. Exposure to cowpox virus by vaccination or contact with an active vaccination site.
2. A positive Paul's test.
3. Subsequent immunity as shown by absence of a vaccination reaction.

Bettley (*6*) maintains that it has not been proved that cases of Kaposi's varicelliform eruption are caused by the vaccinia virus. His patient had pre-existing eczema and developed pustular lesions of the extremities while in the hospital. He had had no discoverable contact with an active vaccination. Paul's test was negative and the patient had been successfully vaccinated prior to the eruption. Bettley also pointed out that the cases previously reported by McLachlan and Gillespie (*7*) all yielded a negative Paul's test.

Very few of the reported cases have fulfilled all three of the criteria demanded for etiologic proof; especially often have the second and third been lacking. In many instances Paul's test was not performed; in some it was negative. In one of Freund's cases (quoted by Tedder), Paul's test was positive but the patient was later successfully vaccinated. In the case of Platou and Tedder the intracerebral implant of the dead child's brain tissue into rabbits produced a positive result with central nervous system involvement and death. Also the Mandler filtrate from these rabbits' brains killed two rabbits on intracerebral

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inoculation after 7 to 14 days. Wollnitza (*8*) claimed the demonstration of vaccinia virus in the blood and urine of his case.

Anders (*9*) stated that eruptions which were identical with the picture of true generalized vaccinia were extremely rare, and gave the following statistics:

Observer:	*Number of vaccinations*	*Cases reported*
Chaveau	500,000–600,000	6–8
Haslund:		
1888–98	39,915	4
1893–97	170,576	3
Vogt	100,000	5
Groth	2,285,579	50–60

Ronchese added the following, quoted from Lynch:

Observer:	*Number of vaccinations*	*Cases reported*
Wolff	7,000	0
Brayton	40,000	6–7
Schamberg (15 years of dermatologic observation)		5

Ellis quoted the rate of occurrence of cases of generalized vaccinia to vaccinations as 1 in 30,000, based on 900,000 cases by Danziger, and 1 in 40,000, based on 3,000,000 cases reported by Anders.

Haslund, quoted by both Anders and Ellis, stated that Groumy revaccinated 175 Belgian Army cadets and that of 64 who had takes, 12 had typical generalized vaccinia, 4 of these also having high fever, angina, mucosal lesions, and bronchitis.

At this camp 2 cases of generalized vaccinia and 1 of postvaccinial exanthem occurred in over 122,000 vaccinations.

CASE REPORTS

Case 1.—A 19-year-old white male had been vaccinated 12 years previously. He was revaccinated and went through the usual stages of a positive unaltered take. Nine days later his face reddened and he thought he was sunburned. The next morning a sore appeared on the right lower ear lobe and he picked a scab. Within the next 24 hours, a profuse eruption appeared over the face, neck, and left forearm. The eyelids swelled and occluded both palpebral fissures, the right side first and then the left.

There was a necrotic bulla the size of a dime on the left outer arm on a larger area of erythema and induration, with a few turbid vesicles in the periphery. An erythematous halo involved the entire lateral surface of the arm. Scattered over the left arm and forearm were discrete pinhead-size and larger turbid vesicles with central umbilication on an erythematous indurated base. There were similar but larger discrete and coalesced lesions on the face and neck. Many had become abraded and macerated as the result of trauma and the application of compresses. Edema and erythema of the whole face were quite prominent. Lymphadenitis was present in the left axilla.

The admission temperature, 11 days after vaccination, was 102.4° F. and descended gradually to normal in 3 days. The pulse rate was 100 and became normal within 24 hours.

With bed rest, cool boric acid solution compresses, and gentian violet solution for the abraded lesions, the patient made a gradual and uneventful recov-

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ery. After 16 days the crusted lesions separated and left erythema and scaling. Many slightly depressed ovoid scars remained on the face.

Case 2.—A 37-year-old white male gave a history of recurring furunculosis up to 10 years previously, and attacks of prickly heat during hot weather for many years. He had never been vaccinated. He reported for duty with an attack of miliaria. He was vaccinated 4 days later. The take was first noticed 1 week later. Nine days postvaccination he felt feverish, the face became red, then swollen, and that evening blisters appeared around the right ear, broke and oozed. Within 24 hours, crops of blisters appeared all over the face, neck, chest and groins.



Case 1.

When seen 11 days after vaccination, the entire face was edematous and erythematous; both eyes were closed by the swelling of the lids. There were groups of discrete and coalesced large pustules, some ruptured and oozing, others intact and centrally umbilicated, profusely scattered on the face and neck, and less so on the upper chest and inner thighs at the groins. On the forehead the lesions extended into the hair line. There was a dime-size vaccination crust just below the left deltoid region, surrounded by edema and erythema. Above it were three smaller secondary vaccination crusts. There was lymphadenitis in the left axilla.

A scratched, severe prickly heat rash was present on the back and chest, far beyond the areas containing vaccinial lesions.

The temperature on admission was 103.5° F., the pulse rate 105. Both descended to normal in 48 hours. Two blood counts were done and showed only a slight leukocytosis (10–12,000 leukocytes); urinalyses were normal.

On bed rest and local therapy, the lesions became crusted and the crusts separated in 14 days. No scars remained except on the sites of the original vaccination and the three secondary takes.

Case 3.—A 36-year-old white male was in the hospital awaiting survey for seropositive syphilis. He had been vaccinated in childhood. On arriving in camp

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he was revaccinated and developed a good take. Ten days after vaccination, while in the hospital, a generalized eruption appeared which was accompanied by burning and itching. Scattered over the entire body were pinkish, edematous papules more raised and indurated than urticarial lesions. Some became confluent on the back, and all appeared within 12 hours. Three days later, the lesions flattened, many became confluent and arranged in large figured patches of pink macules with fading centers.

There was a 3-centimeter, brawny, deep-red induration on the left outer arm with a central, blackish gray, crusted ulcer, ½-centimeter in diameter, surrounded by tiny pustules. There was lymphadenitis of the left axilla. The temperature was normal and the eruption faded completely in 8 to 9 days. Since drug and other possible causes were absent, the diagnosis was erythema multiforme type of postvaccinial exanthem.

SUMMARY

Three cases of cutaneous complication of cowpox vaccination are reported in over 120,000 vaccinations in a camp.

Two were cases of true generalized vaccinia. One occurred in a previously vaccinated man who had no pre-existing dermatosis; the other patient had not previously been vaccinated but did have a pre-existing dermatosis.

The third case was a true postvaccinial exanthem of the erythema mulitiforme type and appeared in a man who had previously been vaccinated and had no other dermatosis.

All cases occurred at the height of the vaccination reaction and disappeared spontaneously within approximately 2 weeks.

The relatively rare occurrence of such complications conforms to the findings of others as reported in the literature.

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HEADACHES—TENSION TYPE

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The only report found in the literature resembling tension headache was that of Elkins and Williams [1] on myalgia capitis. A number of their cases had been misdiagnosed as suppurative ears or sinuses, or migraine. They concluded that the head pain had originated in the scalp muscles and physiotherapy was instituted.

All the patients seen here with this type of headache presented the same symptomatology. They complained of severe headache, either unilateral or bilateral, with involvement of the occipital, parietal, or frontal region, or of all three. The headache was somewhat migraine in character, sustained, with no period of regression and without nausea. After all other diagnoses had been ruled out and the usual therapy proved of no value, it was concluded that this might be a so-called tension type of headache.

Almost invariably the patients stated that they noticed a tender area upon the scalp while combing or washing their hair, and upon palpation of the scalp this tender area could be elicited. Many of the patients were under stress and strain.

It was decided to inject this tender area and the immediate vicinity with 1-percent procaine hydrochloride, allowing the solution to traverse the fascial planes. The patient was given a barbiturate, and the tender area was prepared with alcohol; shaving was unnecessary. Ten centimeters of 1-percent procaine was then injected intracutaneously, using a 22-gage needle to form a wheal, and a 20-gage needle with which to infiltrate the area of tenderness down to and below the aponeurosis. No untoward symptoms were encountered except a slight feeling of fullness and numbness around the scalp. The headache was quickly alleviated and the patient was allowed to return to duty. The patients were usually symptomless for a week to 10 days when the symptoms recurred but less severely. The procedure was then repeated until cessation of symptoms was obtained. Usually two to three injections were necessary before there was no further recurrence. A control was established by the injection of distilled water

[1] ELKINS, E. C., and WILLIAMS, H. L.: Myalgia of head. Arch. Phys. Therapy 23: 14–22, January 1942.

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instead of procaine hydrochloride without beneficial results, and procaine had to be resorted to immediately.

The procedure described should be attempted only in selected cases where there are no organic lesions and the typical symptoms and positive physical findings of tension headache are presented. No harmful effects were observed in any of these patients.

The rationale of the procedure is that with involvement of one muscle, for example the occipitalis, the fascia aponeurosis is put on stretch, thus affecting the occipitofrontalis muscle. With involvement of the entire occipitofrontalis muscle, a vicious circle is started. If this sequence of events can be halted, the headache can be relieved.

Advantages of the injection therapy as described are that (1) the patient will not have to lose any time from his duty, (2) the procedure is very simple, and (3) it may be used as a diagnostic aid to rule out migraine.



SLOW UNION OF FRACTURES

During the past year or so there has been more than one reference to the impression held by many that fractures are taking longer to unite than formerly. If this were true it would, under present conditions, be a matter for serious concern, for fractures exert a drain upon manpower both in industry and in the Services.

A clear distinction must be drawn between the biological process of fracture healing and the modifications in this due to the methods of treatment used. There is little evidence that the biological conditions are any different now from those of 30 years ago.

The delaying factors came into force suddenly some years before the war and naturally there has been a tendency to interpret this as being the result of a sudden change in methods of treatment. Skeletal traction and unpadded plaster splints are suspect as are interrupted immobilization, traction, and distraction, infection, persistent angulation, too early weight-bearing, and loss of blood supply. In skilled hands operative reduction does not cause delay. The decision to use this method for unstable fractures should be made early rather than as a last resort.

It will surprise most people to read that of 3,000 fractures investigated, no less than 42 percent, or 1,276 fractures, suffered from mal-union, of which 896 had bad function (i. e., 30 percent of the total). Even in the anatomically good results (1,736 fractures, or 58 percent) there were 160 cases with bad function. Of 3,000 fractures, therefore, the functional bad results numbered 1,056, or 35 percent.—Editorial. Slow union of fractures. Brit. M. J. 669–670, May 29, 1943.

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"BLIND STAGGERS"

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Large numbers of Negro recruits, mainly from the eastern half of the United States, have been screened by the psychologists and psychiatrists at this training station and many were held over for observation because of varied complaints.

Many complained of episodes of "blind staggers" or "swimming in the head," the onset of which was sudden. The duration was most commonly from 5 to 10 minutes, although some episodes lasted as long as an hour and the frequency varied with the individual case. The precipitating causes most often expressed were overheating, overexertion, exposure to sunlight, and excitement. The history usually given was: "When I work too hard or get hot I suddenly get a headache, my head swims, there are spots in front of my eyes, and I walk like a drunkard. I have to sit or lie down until it passes."

Interestingly enough, physical and neurologic examinations were almost invariably essentially normal. During an attack the subject complained of generalized headache and walked on a wide base. He staggered and fell when tested for the Romberg sign, but there were no other neurologic findings.

The background of almost all of these inductees revealed their marked tendency to take refuge in somatic symptoms and neurotic traits, such as enuresis, somnambulism, nailbiting, nervousness, etc. Many were markedly suggestible. A small number have had authenticated head injuries and convulsive seizures of the grand mal type.

The episodes were hysterical and psychogenic in origin. When they appeared in the authentic head injury and epilepsy patients, the symptoms were regarded as a psychologic crust on an organic basis. When these patients were first seen the syndrome was variously regarded as possibly a form of petit mal epilepsy or some disorder akin to Meniere's syndrome. Unfortunately, the facilities at this training station afforded no opportunity for anything other than clinical studies. Electroencephalograms would have been very interesting.

This syndrome does not occur exclusively in Negroes. A number of white inductees with similar complaints have been examined and there was no doubt as to psychogenicity of the symptoms and the psy-

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choneurotic personality traits. All presented anxiety and tension symptoms as well. The white inductees with reliable histories of head injuries and epilepsy did not present this particular collection of symptoms.

The following treatment has been given:

1. Careful physical and neurologic examination.
2. Assurance that nothing abnormal can be found (in those cases without epilepsy).
3. A simple explanation of the influence of emotional factors on the body and its symptoms.
4. Strong reassurance and simple, brief psychotherapy of individual problems.

It has been impossible to follow more than a few patients but these have all done well thus far on duty. A number of recruits were surveyed out because the complaints and personality structures were such as to render them potential psychiatric casualties. It would be interesting to obtain more objective evidence about such groups of symptoms in order to substantiate or dispel the clinical impression obtained.

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COMMON COLD

The common cold is the most frequent infectious disease in the United States and it is economically the most wasteful.

The causative agent is a specific filterable virus, and in cases uncomplicated by secondary bacterial invasion the cold is a short, self-limited disease.

The frequency of secondary bacterial invasion increases the morbidity of the common cold to such an extent that the physical disability produced by it constitutes a major industrial problem.

The ideal methods of preventing contagion: isolation of the infected individual, adequate spacing, and sufficient natural immunity to resist repeated colds. They are chiefly useful in the prevention of secondary bacterial complications. The wholesale and indiscriminate administration of cold vaccines lacks scientific data in support of their use.

No so-called abortive treatment of a cold shortens the disease. Bed rest may prevent its complications.

In the absence of the specific virus, chilling and fatigue do not cause colds, but probably diminish resistance to the infecting agent.

The ideal method of air sterilization may prove to be the combination of mechanical air conditioning and air filtration with either ultraviolet light or with one of the effective aerosols such as propylene glycol. The optimum method will depend upon the size and other physical features of the particular space to be sterilized.—LEOPOLD, S. S.: Common cold as industrial health problem. Proc. Seventh Annual Meet. Indust. Hyg. Foundation of America, Mellon Institute, Pittsburgh, Pa., November 10–11, 1942.

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APICOECTOMY IN WAR DENTISTRY

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The devitalized anterior tooth is one of the major dental problems on board a battleship. If the offending tooth is extracted a problem in esthetics, space retention, and tooth replacement is created. For this reason, root canal filling and apicoectomy have often been deemed advisable.

Many of the patients examined had devitalized teeth with no apparent symptoms other than a change in color of the crown of the tooth, whereas others had acute alveolar abscess or chronic abscess with or without fistula. All suspected teeth were radiographed and studied to ascertain the best method of treatment. In a 4-month period, root canal treatment and filling and apicoectomy had been done in 15 upper and lower anterior teeth. Although it is impossible to predict the ultimate success or failure of these procedures, the outcome of the cases has been successful at least up to the present writing. Judging from previous experience, it is safe to say that the areas operated on fill in gradually with new bone and that the usefulness of the tooth is greatly prolonged by this operation. In one instance three lower incisors were successfully treated and operated on in one sitting.

Acute conditions are treated symptomatically, either by incision and drainage, or by drainage through the canal of the tooth itself until symptoms have subsided sufficiently to permit reaming, filing, and filling the root canal. Filling is accomplished in the conventional manner, the only variation in technic being the attempt to force the material through the apex and thus overfill. The cavity in the cingulum is also filled at this time. Apicoectomy is then performed.

Chronic conditions of discolored pulpless teeth, radicular cysts, and granuloma with or without fistula are treated in a like manner. The nerve is extirpated and the root canal is filed, cleansed, and filled. Care should be exercised to avoid pushing the instruments through the apical foramen, thereby jeopardizing the dehydration of the canal prior to filling.

Should a devitalized anterior tooth be discovered as the cause of an asymptomatic radicular cyst, and the canal of the tooth has already

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been satisfactorily filled as shown by x-ray, then the apicoectomy may be performed immediately and concurrently with the cystectomy. A sufficient amount of root surface must, however, remain to retain the tooth in situ.

Technic of apicoectomy.—Local anesthesia is administered and a double incision is made. Beginning high in the mucobuccal fold and distal to the apex of the tooth adjacent to the one being operated on, the incision is carried gingivally, converging slightly toward and ending just mesial to the interdental space. A second incision is made beginning distal to the apex of the tooth on the other side of the involved one and also ending mesial to the interdental space. The incisal ends of these vertical incisions are joined by a third incision which runs parallel to and under the gingival crescent and cuts through the intervening papillae well down into the interproximal space.

The soft tissue is retracted by periosteal elevators to expose the field of operation. The tissue flap diverges and widens as the limits of the retraction are reached. There is usually little hemorrhage, depending on the amount of epinephrine incorporated in the anesthetic solution, the type of patient and the vascularity of the part, and the care with which the incisions and retractions have been done.

Approach to the apex is best accomplished with a small scooped or flat bone chisel followed by small rongeur forceps. The window cut must be large enough to permit the easy removal of all granulomatous tissue. The apex of the root is excised with a No. 557 or No. 701 bur in the straight handpiece. Burs should be kept well irrigated with a steady stream of tepid water or saline solution. The first cut is made approximately at right angles to the long axis of the tooth and far enough toward the incisal so that the second cutting of the root will finish the root flush with the surrounding concave bony wall. A large round operative or vulcanite bur is used for this second cut.

The canal filling is now burnished with a heated plastic instrument to insure as good a seal as possible. The labial aspect of the root-end may be beveled slightly to eliminate any possible irritation at this point.

Bony prominences are removed. The cavity is thoroughly irrigated with warm normal saline solution and a small amount of powdered sulfanilamide is dusted into the cavity. The flap is replaced and sutured with fine silk about one-half centimeter above the gingival margin in each of the two incisions. Little tension should be placed on the sutures as the tissue will adapt itself to the normal position. The sutures are removed in from 24 to 48 hours. If they are left too long or placed too tightly they tend to displace the tissue, with resultant disfigurement in this area.

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Postoperative discomfort and edema are negligible. Recovery is uneventful and complete in a few days.

Advantages of this technic are: (1) Reduced operating and chair time; (2) better accessibility and field of vision; (3) sound bony support for tissue margins; and (4) more rapid healing.

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CRUDE PENICILLIN

The growth and preparation of crude penicillin is relatively simple and can be carried out in any bacteriological laboratory. The chief drawback to its use is its instability; however, it can be preserved for long periods if neutralized and kept frozen. It is also relatively stable at ice-box temperature where it usually remains active for several weeks if kept in rubber-stoppered bottles. It should not be left at room temperature for more than a few hours at a time and between treatments it is best to replace it in the ice-box or to refreeze it if the intervals between use are very long.

The crude penicillin is not toxic to animals when administered in large amounts either intravenously, subcutaneously, or intracutaneously; nor are there signs of local irritation of tissues or of development of hypersensitivity in these animals. It also was found to have very little untoward effect on growing tissue cells. In patients no local discomfort was produced by its application to ulcers nor by spraying in throats, but marked irritation sometimes resulted from instillation in the nose. This is much less marked, however, if it is diluted from one to three times with normal saline.

The penicillin exerted its most marked antibacterial effect on streptococci (all except the *alpha-Streptococcus fecalis*), pneumococci, anaerobic streptococci, meningococci and staphylococci. More of the latter were studied than any others and about 13 per cent of them were resistant to the penicillin. The reason for this resistance is not clear. It is dependent to a slight extent on the number of organisms present, for when very few are used in the test their growth can be inhibited. Other resistant organisms included *Esch. coli*, proteus and pyocyaneus. *E. typhosa* was resistant to the regular penicillin but young cultures of two new strains of penicillium on synthetic medium were effective against this organism in low dilutions. Contamination of the media during growth, or of the active filtrate by any of these organisms or by *B. subtilis* may completely inactivate penicillin.

The action of penicillin is bactericidal in the stronger solutions and inhibitory in the weaker ones.

Limited clinical trials in local infections have produced some encouraging results, but have also indicated certain limitations.

Penicillin is effective under some conditions which are unfavorable to the action of the sulfonamides and against certain bacteria not sensitive to that group of drugs. It seems likely that even the crude form may prove to be of value in the local therapy of infections.—FISHER, A. M.: Anti-bacterial properties of crude penicillin. Bull. Johns Hopkins Hosp. 73: 343–373, November 1943.

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EVALUATION OF AMMONIACAL SILVER NITRATE

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The use of silver nitrate in the control of dental caries goes back to 1846. In the early years silver nitrate was used in aqueous and alcoholic solutions of various strengths and in the form of fused crystals. Not until 1917, however, when Howe (*1*) introduced the ammoniacal form, was its value as an inhibitor of dental caries generally recognized. As used by most dentists today the solution has a 30-percent metallic silver content.

By the action of silver nitrate, the dental tubules are impregnated with finely divided metallic silver, a potent germicide. Microbes cannot feed upon metallic silver; they require nutrition.

By ammoniation, chemical attack upon the lime salts of the tooth and further disorganization of the mineral structure is avoided. Irritation to the pulp tissues is also reduced by using the ammoniacal form.

Ammoniacal silver nitrate is prepared as follows: To a 5-percent silver nitrate solution, full-strength ammonium hydroxide is added, drop by drop. A black precipitate is formed. Ammonium hydroxide should be added until this precipitate is dissolved on shaking. The solution should be agitated as ammonia is added. To the completed solution is added, drop by drop, while shaking, 10-percent silver nitrate until the solution becomes slightly cloudy or opalescent. This opalescence must persist as the solution is shaken. If, however, the opalescence does not appear, a few drops of 10-percent silver nitrate may be added until it does. If kept in the dark, this solution will keep for 2 or 3 months.

I prefer to use the solution put up in ampules. Ampules of silver nitrate and formalin are now included in the Supply Catalog. These remain fresh until the last drop. Unless the containers can be sealed after each opening, the metallic silver is precipitated upon the glass container and soon the solution is not of the required strength to give the best results.

The method of applying silver nitrate is simple. It is important, however, that the tooth be thoroughly dry. The solution should be allowed to remain on the tooth for from 40 seconds to 1 minute before following it with a reducing agent, after which the area may be wiped

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dry with cotton to take up the excess eugenol or formalin. Spunk cut into small cubes is a satisfactory vehicle for application.

Should the cavity be left with a gangrenous mass undisturbed, it will restrict the penetration of silver nitrate in proportion to the density of the mass. On structures which have been invaded by bacteria, the silver nitrate continues its penetration through the infected area, chemically changing the mass into ar inert substance. Once past the digested area, protoplasmic structure is encountered, coagulation ensues, and the action ceases.

The question is often asked, "Will the application of ammoniacal silver nitrate devitalize a vital pulp when placed in proximity to the pulp?" My experience bears out the truth of Cleary's (*2*) statement that when devitalization of a pulp ensues following the application of ammoniacal silver nitrate, it occurs in spite of, rather than because of, the silver nitrate. The causative factor is the bacterial invasion and is not due to the chemical action.

The nitrate has to be reduced to insure the sterilizing and immunizing effect. The simple application of the salt does not render the area immune; that is, a reducing agent is necessary to secure the oxide form of the already-formed albuminate. The reducing agent follows the silver nitrate into the tubules of the dentin to its deepest penetration and deposits the metallic silver.

There is some reluctance to use an agent which sometimes causes such definite stains, and this has prevented silver nitrate from receiving the general recognition it deserves. The discoloration, however, is not noticeable on the posterior teeth, and often keeps small carious spots from becoming large cavities. Furthermore, on a well polished tooth surface the silver nitrate makes no impression and leaves no stain unless the enamel is defective or disorganized, while at the same time the penetration is in direct proportion to the depth of the defect or disorganization. For this reason silver nitrate may be used as a diagnostic aid after cavity preparation. The application and reduction of silver nitrate will show up every spot of decalcified and affected tooth structures.

The operator must guard against the tendency to allow too much soft decay to remain in a deep cavity, relying upon silver nitrate to control it. All soft carious material should be removed. Only the leathery material directly overlying the pulp chamber may be allowed to remain. I recently replaced 25 amalgam restorations in the mouth of a 26-year-old patient who had been the victim of just such treatment. After examination and roentgenographic survey the restorations were removed to reveal in each, deep, soft caries below the precipitated silver nitrate. This was probably due to (1) removing insufficient

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carious dentin, and (2) attempting to precipitate the agent in a cavity that had not been thoroughly dried and dehydrated. The necessity of having the cavity or surface for the precipitation of the silver nitrate thoroughly dry cannot be overstressed.

Occasionally teeth become decayed beneath amalgam or gold restorations with good margins. This could have been obviated by the use of silver nitrate as a diagnostic aid in cavity sterilization to reveal, after cavity preparation, whether or not all infected material had been removed. There should be such a staining check with ammoniacal silver nitrate after the preparation of every cavity in the posterior area of the mouth. It often reveals, in supposedly clean cavities, that not only a small spot of affected dentin remains, but perhaps also a slight amount of debris in the angles of the cavity.

TREATMENT OF INTERPROXIMAL AREAS

Healy (*3*) has cynically stated that "Dentistry was comparatively easy, as far as cavities were concerned, until the bite-wing film was used to reveal hidden areas of decay and decalcification." These decalcified areas may be divided into two classes; those which penetrate through the enamel into the dentin, and those which penetrate only the enamel. The first type must be restored by mechanical means; the second can be treated with silver nitrate as follows:

The area to be treated is isolated with a rubber dam or cotton rolls and cleaned with alcohol or chloroform. Dental floss is gently passed through the contact point (bleeding of the gingiva would necessitate postponement of the treatment). The area must be thoroughly dry. Blowing too strong a blast of air should be avoided, however, as this may also initiate hemorrhage of the gingival tissues. A small, tightly rolled pellet of cotton dipped in ammoniacal silver nitrate is then applied to the contact point. Three minutes are allowed to elapse before reducing with eugenol. After application of the eugenol, 3 more minutes are allowed to elapse. Formalin is contraindicated in contact with soft tissues. The surplus solution is cleaned off with rubber cups and cleansing paste.

Another method of application is with dental floss or tape. A saturated section of tape is passed between the contact points several times, rubbing them thoroughly. This method may be rather messy and some will prefer to apply the solutions either with pellets of cotton or with silver nitrate applicators.

These areas will be rendered immune for years to come by the metallic silver precipitation, provided they are regularly cleaned with dental floss by the patient.

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TREATMENT OF ACHING TEETH

In some cases aching teeth can be treated by the method advocated by McFall. The tooth and cavity are syringed several times with warm water and the cavity is gently wiped with a pledget of cotton. Eugenol is applied to the area nearest the pulp after the cavity has been well dried and protected. Then, with warm air, fumes of the eugenol are gently forced into the pulp chamber. The cavity is sealed with a eugenol dressing and the area around the tooth gently massaged. This helps to restore the circulation and relieve engorged blood vessels.

The patient is asked to return in 36 hours, at which time the temporary filling and medication are removed. If the tooth has been comfortable since the patient's last visit, it is syringed with warm water, and all overlying leathery or soft decay around the dento-enamel junction is removed, except that portion directly over the pulp. Then in a dry protected field, ammoniacal silver nitrate is applied and left in place from 3 to 15 minutes, and is followed by the application of formalin.

A double precipitation is sometimes a good precaution; therefore another dressing of eugenol may be inserted. The patient is instructed faithfully to massage the gum area around this tooth, and to brush his teeth well. He is instructed to return in 3 days, sooner if there is pain.

At the end of that time the temporary filling is again removed and the tooth syringed with warm water. The topmost layer, not the deep protective layer, of leathery decay is then gently removed from the pulpal wall. A protective anodyne dressing is inserted and cavity preparation continued. A temporary cement filling is inserted at this time and the patient is instructed to continue massaging the area around this tooth, to chew upon it lightly, and if no pain is felt to return in 10 days. If there has been no pain in this interim, the cavity is immediately prepared and the desired restoration inserted. If possible this tooth should be checked in 3 and 6 months. The procedure described may seem to be long and drawn-out, but it is a means of saving many teeth that would otherwise be lost.

PULP CANAL TREATMENT

In the treatment of teeth with a pulpal involvement, two things must be attained: (1) Sterility must be produced, and (2) provision must be made for the permanent walling off of the remaining sound tissue. After organic matter is destroyed, the tubules should be filled with a substance (metallic silver) which will remain permanently antiseptic.

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TREATMENT OF PERIODONTOCLASIA

Silver in nitrate form has the advantage of combining with organic material after the removal of its caustic properties by the proper use of ammonia. Therefore, when soft tissue is involved, as in pyorrheal conditions, the pathologic soft tissue is cauterized to the point of contact with sound cells. The cementum, which is susceptible to infection, is rendered aseptic. There is no reattachment to the surface when silver has been reduced and the pocket not eliminated, but normal soft tissue will cling tightly to cementum that is surgically clean. Formalin, as stated previously, should not be used in reduction of silver nitrate when there is contact with soft tissues.

SUMMARY

The bulk of dentistry outside the combat zone, in field stations, aboard ship or at shore stations, is operative dentistry. With silver nitrate many teeth can be cared for in the field and under conditions that would otherwise require extraction.

The use of silver nitrate is recommended in the fissures of every molar that the smallest tine of an explorer will enter.

Deep sterility in tooth structure is produced by the deep penetration of ammoniacal silver nitrate. Thus the time allowed for penetration before reduction is an important factor.

The penetrative action of silver nitrate requires a thoroughly dry surface.

Hypersensitive conditions at the gingiva as well as irritation caused by partial denture clasps is greatly relieved by the application of silver nitrate.

Silver nitrate with proper care maintains hypoplastic teeth in a healthy condition.

If the margins of a cavity preparation have been accidentally stained with silver nitrate, the cavo-surface should be rebeveled. The application of iodine on a pellet of cotton, followed by aromatic spirits of ammonia similarly applied, will remove the stain from most spots accidentally touched.

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LESIONS OF THE MOUTH AND FACE OF SPECIAL INTEREST TO THE DENTAL OFFICER[1, 2]

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Because systemic disease so often initially demonstrates its presence in the mouth and on the face, it is of vital importance for the dental officer to recognize lesions in these areas. Conditions of war necessitate a closer congregation of man, increasing the opportunity for the transmission of disease. Changes in environment and eating habits under restricted food intakes bring on deficiencies, together with predisposition to serious body infections, the initial indications of which may occur in the mouth or on the face.

Mycotic infections from vegetable microorganisms.—The Actinomyces bovis or ray fungus causes the infection known as actinomycosis or lumpy jaw, which is clinically demonstrated by the formation of abundant granulation tissue, with multiple abscesses discharging an exudate containing colonies of characteristic yellowish granules. The prevailing location of the disease around the jaws and neck suggests transmission through the mouth by means of grass or straw. Other parts of the body, as the respiratory organs and alimentary tracts, are also affected. The Actinomyces bovis is anaerobic, and occurs in pus and tissue as rounded or spherical granules about 1 mm. in diameter, which are usually yellowish or sulfur colored, but may be red, gray, or dirty white. In the cervicofacial type the submandibular area begins to swell and the disease extends into the neck. The mandible begins to ankylose, followed by muscular trismus with painful, tender swelling about the teeth. The cheeks, the masseter muscle, the parotid gland may be invaded, with further extension to the skull, meninges and brain. Treatment should consist in care of apical abscesses, periodontoclasia, or other dental and stomatic infections as prophylactic measures. Surgical drainage, massive dosage of iodides, x-ray and radium therapy are of value.

Moniliasis is caused by fungi widely distributed in nature, being found growing on dead leaves, fruits, decomposed wood, in human and animal excreta and on the mucous membrane of the mouth and the skin surface. When this infection involves the mucous membrane

[1] Presented before the Northeastern Dental Association, Swampscott, Mass., 16 June 1943.
[2] From the U. S. Naval Dental School, National Naval Medical Center, Bethesda, Md.

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it is more commonly known as thrush, and may be recognized clinically by the white patches on the mucosa of the cheeks and lips. The disease responds to alkaline antiseptic mouthwashes, with local applications of potassium permanganate (1:1,500) or a ½-percent iodine solution.

Spirochetal infections.—Vincent's angina, Vincent's infection, or trench mouth begins usually as an acute tonsillar infection which may be unilateral. There is a superficial necrosis progressing toward the third molar region, and in turn involving the lips and portions of the face. From the necrotic areas a dirty yellow exudate flows, and when these areas are clean of necrotic tissue a bleeding surface remains. There is usually also a foul breath, excessive salivation and rise in temperature. Diagnosis may be confirmed by the clinical picture and the demonstration of Vincent's spirilla and fusiform bacilli in smears obtained from the gingival crevice. Treatment consists in first obtaining as good a condition of oral hygiene as possible by the use of oral irrigations, removal of food debris and superficial salivary calculus. Topical germicides may be applied except those liable to irritate the damaged mucous membrane, followed by mouthwashes liberating nascent oxygen. The organisms being anaerobic cannot exist in this medium. The removal of dead keratinized epithelium is accomplished by daily irrigations and swabbings. Quantities of fruit juice together with large vitamin dosage are of great value.

Syphilis is a specific infectious disease of protean manifestations, caused by the Treponema pallidum, and may be acquired or congenital. In the acquired form there is an initial lesion often manifesting itself on the lips, tongue, and face, followed by an early stage of invasion with relatively mild systemic disturbance. Extragenital chancres are most common on the lips and on the fingers. These are dangerous because often unrecognized, and no precautions are taken to prevent transmission.

The chancre appears as a small papule, eroding into a reddish ulcer covered by a gray-yellow exudate. It is somewhat elevated, but not excavated and is distinctly circumscribed with little or no areola of inflammation. The shotlike consistency cannot be detected until 1 or 2 weeks after the onset. Often the chancre may appear as a simple erosion, without induration, and may never ulcerate but appear only as a simple papule without pain and go unnoticed. It may heal without treatment in from 4 to 6 weeks.

The mucous patch is the most characteristic, persistent and infectious of all syphilitic eruptions. It is papular in character, free from induration and covered with a yellow-white exudate. Multiple, they often coalesce to form large irregular areas, persisting often for months.

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In the treatment of the secondary period of syphilis the chancres and the skin eruptions disappear quickly, giving the impression to the patient that he has been "cured."

cing and ulceration of small gummas, producing large areas of

True gummas are lesions of late syphilis, and form by the coales- necrosis. The exudate from these areas dries and forms a crust: continued exudate leads to another crust, and beneath this another until layers appear. These gummas recur and persist for many years and are highly contagious. The skin and mucous membranes often undergo a peculiar diffuse infiltration. At the corners of the mouth appear fissures, becoming deep and ulcerated. When these heal they produce a typical linear radiating scar.

Yaws or frambesia is caused by another spirochetal organism, the Treponema pertenue, and occurs chiefly in tropical countries. There is an initial cutaneous lesion, followed by a papular, granulomatous skin eruption, and in some instances destructive lesions of the skin and bones. These may appear as large warts, ½ to 4 cm. in diameter, covered by a crust, with a raspberry-like formation; hence the name "frambesia."

Gangosa is associated with yaws, and possibly syphilis, and is the term applied to chronic ulcerative and destructive lesions involving the soft parts and cartilage of the nose. It may extend to the bony structure of the nose, the nasopharynx and the cutaneous tissue about the nose, and mouth. There may be extensive ulceration of the soft parts, and the floor of the nasal passages may communicate with the oral cavity because of partial destruction of the palate.

Leprosy and verruca peruana are rarely seen in the United States, but their lesions may resemble yaws and gangosa when located on the structures in and about the mouth.

American leishmaniasis affects the mucous membranes of the mouth, nose, and throat producing a fungating ulcer; it is rather prevalent in Brazil, Peru, Bolivia, and Paraguay. The organism is the T. braziliensis. The sandfly is the probable transmitter.

Diseases due to chemical agents.—Arsenic poisoning is usually occupational. The eyelids, and skin on the neck show an increased pigmentation and the septum of the nose may be perforated. Diagnosis is facilitated by inquiry into the patient's work and by chemical analysis of the urine, hair, and nails.

Mercury may be absorbed when taken therapeutically by mouth, injection, inunction, or in vaginal douches. The onset is rapid with vomiting, a metallic taste, and often a marked stomatitis. In mercurial overdosage, stomatitis, salivation, metallic taste, reddish-brown discoloration of the buccal mucosa, gingivitis, loosening of the teeth,

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and occasionally marking of the gums similar to the lead line may be observed.

Lead poisoning has long been a well-known occupational disease. The lead line on the gingiva is an important sign. Lead sulfide is deposited about the blood vessels in the tips of the papillae and appears most plainly about the gingiva of periodontoclasias. This line has a punctate appearance and lies below the free gingiva. A piece of paper inserted between the gingiva and the tooth distinguishes stippling from staining of the tooth root.

The bismuth line is a very common sequela of bismuth therapy in the treatment of syphilis. It is located at the free margin of the gingiva, is bluish black, and less sharply defined than the lead line. Occasionally there is extensive pigmentation with blackish plaques of variable size on the gums and mucosa, punctate or diffuse pigmentation of the soft palate, and blackening of the filiform papillae of the tongue and even of the veins under the tongue.

Radium poisoning may present an extensive, intractable necrosis of the mandible and maxilla with death due to the necrosis, severe anemia, and terminal sepsis. The bone tumor found is an osteogenic sarcoma.

Proprietary headache remedies used habitually, particularly if containing acetanilid, may cause cyanosis of the lips. Potassium iodide may produce an acute catarrhal condition of the nasal mucous membranes, a coppery taste, and an increased secretion of saliva with soreness of the salivary glands.

Deficiency diseases.—In pellagra, glossitis and stomatitis are early and common symptoms. The tip and margin of the tongue are swollen and reddened, followed by deep penetrating ulcers if treatment is not given. A thick gray membrane filled with debris and Vincent's organisms covers the tongue, which is usually hypoesthetic. The buccal folds, the vermilion border of the lips, the gingiva and the palate may likewise be affected. A burning sensation of the tongue is not uncommon and this is aggravated by hot acid foods. The diet must be changed from an inadequate one, high in carbohydrate and fat content to an adequate intake of mineral salts and vitamins, with increase in proteins. The use of a mouthwash to increase oral cleanliness is valuable. The teeth should be brushed gently to avoid severe hemorrhage.

Riboflavin deficiency occurs in those individuals subsisting for a considerable time on an inadequate diet. There are characteristic angular stomatitis lesions, with transverse fissures. Synthetic riboflavin or substances containing riboflavin, produce good results and change the abnormal shiny redness of the mucous membrane of the

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lips and the "sharkskin" appearance of the skin around the nasal alae, eyes, ears, and zygomatic prominences within 4 to 6 days.

Scurvy is a nutritional disorder caused by a prolonged inadequacy of vitamin C. The gingiva becomes very painful upon the ingestion of food, and bleeds easily. The lips become cyanotic and the gingiva begins to show erosion of the mucous membrane at the free margin, with calculus and fetid breath.

Rickets is a deficiency disease caused by insufficient vitamin D during the growing period. The frontal and parietal bones of the skull become usually prominent, and later are thickened, producing the so-called square head.

Tropical sprue is a chronic, afebrile disease characterized by a marked glossitis. The tongue and mouth may or may not be sore. Defective teeth and poor oral hygiene with a poor or perverted appetite, and idiosyncrasies of diet often fixed by habit contribute. If sprue is untreated the tongue and mouth become sensitive to hot or seasoned foods, and crops of small, very sensitive aphthous ulcers may appear on the buccal mucous folds. The tongue is beefy red and sore, with marked papillary atrophy.

Local diseases of the gums, tongue, lips, and teeth.—Oral sepsis may occur from alveolar abscess, chronic suppurative periodontal disease, and infected radicular and dentigeous cysts. In these cases there is a subnormal health level, with moderate anemia, and leukopenia with relative mononucleosis.

Dental caries or dental decay is characterized by a primary lesion or "chalky" area of white decalcification of the enamel, caused by the action of acid produced by the Lactobacillus acidophilus; and other lactobacteria activated by yeast organisms acting as catalysts. This decalcification of the inorganic matrix of calcium and phosphorus occurs especially on those areas where the enamel cuticle remains, facilitating attachment for bacterial plaques. In the enamel lamellae and those areas not self-cleansing, these organisms have a suitable susceptible area even though the enamel cuticle is not present. These initial etched lesions produce a means for attachment of carbohydrates in which the acid-producing organism lives, and of protein in which the proteolytic organism lives. This latter organism is believed to be the Streptococcus salivarius, and may be cultured from saliva of susceptible patients. It lives on the protein present in the debris in the cavity, and produces the typical brown discoloration of secondary or true caries. When the protein dentin has been reached it liquefies the dentin, except in those areas where the dentinal tubuli have been occluded, producing clear or nontubular dentin. Adequacy of mineral salts and vitamins plays a large part in the protective process.

Mottled enamel appears as a chalky white spotched appearance of the permanent teeth, which later becomes brown. It is caused by fluo-

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rine in the drinking water. One-half part of fluorine per million is considered safe, while 2 parts per million reaches the danger line.

Catarrhal stomatitis may be caused by digestive disturbances or the sucking of unclean articles. The apparent causative factor requires attention.

Ulcerative stomatitis develops rarely in persons in good health. Carious teeth, calculus, and poor hygiene are causative factors, together with dietary deficiencies. There is swelling and redness of the gingiva, and oozing of blood in the labial area of the mandibular incisors and buccal area of the molars. Necrosis sets in and ulceration spreads along the gingiva to the cheek and lower side of the tongue, and is covered by a yellowish adherent slough. Lymphatic glands are enlarged and tender, salivation, coating of the tongue, and putrid odor to the breath also being present. Mastication is painful, and fever, fretfulness and prostration occur. The alveolar process may be involved and cause loss of the teeth and bone necrosis.

Gangrenous stomatitis, noma, or cancrum oris occurs usually after one of the infectious diseases. There is an extremely offensive breath, and upon the buccal surface, gum or inner side of the lip, a small ulcer covered with gray or black slough occurs, spreading laterally and in depth. The skin over the cheek becomes brownish red and tense, finally black and broken. Gangrene rapidly destroys a large portion of one side of the face and attacks the tongue, palate, and gums. Pain and fever are not marked, but prostration soon occurs and death follows in from 5 to 10 days.

Bednar's aphthae are small ulcers upon the posterior of the hard palate, caused by unnecessary roughness in cleansing the infant's mouth or from pressure of too long a nipple.

Riga's disease occurs in infants after the eruption of the lower incisors. It is very common in Italy. An indurated grayish area occurs on the frenum of the tongue, ulcerates later and may last for months. At intervals pinhead-size, painful nodules appear in the mouth and upon the vulva; these become enlarged, ulcerate and resolve in about 10 days. The alum pencil locally and internal arsenic are of value.

Macrocheilia is due to hypertrophy of the mucous glands of the lip, but may be due to a lymphangioma involving either lip, though more frequently the upper.

Acute cheilitis or eczema of the lips may be caused by wind, cold, sunburn, lipstick, and drugs used in some toothpastes. The lips are inflamed and crusts and fissures occur.

Tongue anomalies include scrotal tongue, bifid tongue, tongue-tie, macroglossia, geographic tongue, black hairy tongue, median rhomboidal glossitis, acute glossitis, Moeller's glossitis, etc.

Leukoplakia buccalis or smoker's patch and keratosis labialis occur principally in middle-aged men. Chronic irritation is the cause.

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Tumors and cysts.—Epulis is a fibrous tumor of the gum, soft, pedunculated or lobulated. It grows opposite the roots of carious teeth. It is easily injured and may ulcerate.

Ranula is an obstructive cyst of the mucous or salivary glands under the tongue. It is translucent, fluctuating, painless and should be excised.

Torus palatinus is an elongated, hard, smooth, nodular mass in the roof of the mouth and is an exostosis of the palatal process of the maxilla. There is a familial tendency. The growth appears during adolescence and gradually enlarges. It is not malignant, but may disturb speech or interfere with denture prosthesis.

Cancer about the mouth causes 3 to 6 percent of all cancer deaths: 85 percent are in males; most are seen after 65 years of age, the rise of incidence beginning at 45. The lip is more frequently diseased than the tongue and cheek, often with multiple tumors. Leukoplakia, oral sepsis, rough teeth or prosthesis, use of tobacco, fissures and scars are predisposing causes. Any indolent ulcer, papillomatous or nodular tumor, or infiltration about a fissure must be viewed with suspicion. Early diagnosis confirmed by biopsy is important. The degree of malignancy and radio-sensitivity determines the success of surgical removal and radiotherapy. Prognosis in cancer of the cheek is not as favorable as in lip involvement. Adamantinoma is a tumor of epithelial structure which develops from the paradental epithelial remains of the enamel organ. It may be recognized by its origin from within the alveolus. It is more common in the mandible than in the maxilla.

PENICILLIN IN RELAPSING FEVER

Relapsing fever is a tick or louse-borne spirochetal infection which occurs endemically in most countries. With overcrowding and poverty, relapsing fever may become epidemic. Arsenic, usually arsphenamine, is said to be the most effective therapeutic agent. The occasional development of arsenic-resistant spirochetes, the frequency of relapses and the hazards and complications which occur after arsenical therapy are disadvantages. The search for a more desirable agent led to consideration of penicillin. Although 100 Oxford units of penicillin per cubic centimeter did not cause a visible decrease in motility of spirochetes in vitro, 1,000 units to heavily infected mice was associated with their complete absence in the blood smear in 2 to 3 days. Of 26 treated mice only 1 (1 percent) died, whereas in the control group 21 out of 27 (75 percent) died. All untreated mice which survived exhibited relapses, while only 4 of the treated mice had a relapse.—Current Comment. Penicillin in treatment of relapsing fever. J. A. M. A. 124: 99, January 8, 1944.

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LOW-GRADE SCURVY

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The history of scurvy is associated with the sailing ships of olden days. In 1570 an Englishman, Captain Lancaster, observed that two jiggers of lime juice given daily to the crew prevented scurvy.

In those days the art of canning, pasteurizing, and preserving foods was still in the distant future as were modern refrigeration, frozen foods, and ventilated storage spaces. It is difficult to realize that even with the advancements in modern preserving and storage, as well as the high quality and variety of foods served, scurvy can still be commonly encountered in our present-day Navy.

The extended cruises occasioned by war conditions have brought about a number of adverse factors. Cruises many times are prolonged for periods longer than originally planned and necessitate a modified rationing of types of food aboard the ships. The increase in the crew due to redesign and reconversion places a heavier burden on the original storage and refrigeration spaces and consequently less fresh fruits and vegetables are available per capita.

Over a period of 2 months, in a routine examination of the entire personnel of this vessel, 64 cases of bleeding gums were found. This represents approximately 14 percent of the ship's complement.

The condition of the mouths revealed typical clinical low-grade scurvy. The signs were multiple, superficial hemorrhages about the interdental papillae. The papillae were edematous and greatly enlarged, at times covering the major part of the tooth crown. The color of the gums varied in intensity from bluish-red to a brownish-red, and was most marked about the anterior teeth. The gums bled freely upon pressure and had a definite spongy consistency. The papillae in the more advanced stages were necrotic, painful, and ulceromembranous gingivitis was present. There was marked salivation and fetor, with the hard palate being tender and the tongue heavily coated with a brown fuzz.

The color demarcation of the gum was very definite, varying in width from 3 to 5 mm. and following the free edge of the gum uniformly. In five cases the upper labial surface of the gum had a varying number of vesicles. No systemic symptoms of scurvy were found in any case.

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Slides were taken and in five cases organisms were found in sufficient numbers to make an indisputable diagnosis of acute Vincent's angina. The rest of the slides showed a negligible amount of Vincent's angina present, not in sufficient quantity to require treatment. The mouths were thoroughly examined for evidence of gingivitis due to calculus or trauma of any sort. No degree of calculus was present nor any condition of trauma discovered to warrant the degree of gingivitis found.

Histories were taken in all cases. The following one is typical:

The patient, 23 years old, in apparent good health, first noticed "pink tooth-brush" 7 to 10 days previous to presentation. This condition became progressively more acute. The gums were tender and swollen. The patient complained of a bad taste and had a fetid breath. He stated his diet consisted mostly of meat and potatoes, that he didn't care for vegetables. His intake of fresh fruits and vegetables was minimal.

The following routine treatment was given all cases: One hundred and fifty milligrams of vitamin C was administered daily for 2 weeks. No instrumentation was instituted nor drugs administered. At the end of this time the oral tissue had in all cases returned to normal, bleeding had stopped, and the color of the gums become a healthy pink. The prompt response to antiscorbutic therapy indicates without doubt that the condition was scurvy.

The 5 patients that had positively diagnosed Vincent's angina were given 150 mg. of vitamin C conjointly with specific Vincent's angina treatment. A rapid recovery followed in all cases.

The therapeutic use of vitamin C indicates without any doubt that a condition of low-grade scurvy was present. If instrumentation and anti-Vincent treatment had been used in conjunction with the vitamin C, one would have been led to believe that the action of the vitamin C was purely complementary. But this proved not to be the case.

Subsequent inspections of the menus were made and it was found that there was a lack of vitamin C in the diet. This was due to the lack of adequate storage space for foods containing this vitamin as well as the fact that on the whole the men were indifferent toward eating vegetables.

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POSTURE AND DISEASE

Orthostatic hypotension, tachycardia, albuminuria, oliguria, flattening or inversion of the electrocardiographic T wave, depression of the motor and secretory functions of the stomach, and dysmenorrhea have all been attributed to the vertical stance. Failures in adaptation are occasionally so acute as to give rise to syndromes of pathological significance, but it has yet to be demonstrated that when these occur posture plays a decisive etiologic role.—HELLEBRANDT, F. A., and FRANSEEN, E. B.: Physiological study of the vertical stance of man. Physiol. Rev. **23**: 220–255, July 1943.

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CLINICAL NOTES

TRAUMATIC ARTERIAL SPASM

RESULTING IN GANGRENE OF THE UPPER EXTREMITY

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The term traumatic arterial spasm is used to designate an ischemia of an extremity caused by direct or indirect injury to the nervous control of its artery. It may apply to any arterial trunk and its distribution in the body but usually implies the involvement of an extremity.

The direct type of injury is occasionally seen at operation. Here manipulation or trauma to an artery may at times cause it to contract to a bloodless, cordlike structure. The vessel may or may not regain its former size during the course of the operation but nearly always allows an ample blood flow soon after operation. During the period of arterial spasm the part distal to this site may become completely pulseless.

The indirect type of arterial spasm is less frequently seen. It is the result of a stimulus to the sympathetic nervous system which supplies the artery. This may take place at some distance from the area affected, as in the case to be reported.

Both types of spasm give rise to the same clinical picture, a pale, cold, pulseless extremity. The injury is usually caused by gunshot wound or fracture. Characteristically there is no venous engorgement or edema.

Differential diagnosis is not difficult. However, since the condition is not prevalent, other possibilities may suggest themselves, as mechanical obstruction of an artery due to pressure of a displaced end of a fractured bone or a hematoma, an angulation at the site of fracture, and arterial or venous thrombosis. These possibilities are not difficult to rule out.

The reported cases of traumatic arterial spasm have occurred chiefly as the result of warfare. They were observed during World War I and the first phases of the present war. Only a few were seen in cases of fractures and severe wounds occurring in civil life.

Montgomery and Ireland (*1*) in 1935 collected 42 cases from the literature and added two of their own. Since then less than a dozen additional cases have been reported (*2*) (*3*). Of these reported cases 9 be-

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came gangrenous as a result of the arterial spasm. All but one of these gangrenous cases were verified at operation as having a high degree of arterial spasm. There were 3 deaths in the 52 cases, 1 from a resultant gas gangrene and the other 2 from complications of the original injury not associated with the arterial spasm.

The therapy which has been advocated varies widely but has been directed toward breaking the sympathetic nervous control over arterial spasm. This has been done by operation to remove hemorrhage about an artery, application of warm saline packs to the arterial wall, periarterial sympathectomy, and ganglionectomy. Ligation of the concomitant veins and novocain injection into the controlling sympathetic ganglion have also been advocated. Among the nonoperative forms of therapy suggested are the pavex boot and the use of vasodilating drugs, such as papaverine.

It is obvious that the treatment used will vary with the individual case. If there is an associated fracture which might have brought about the spasm, it should be reduced before operation is undertaken. A novocain sympathetic ganglion block along with papaverine medication may be attempted. In the case of a severely lacerated and traumatized wound, on the other hand, open exposure of the vessel might be indicated with periarterial injection of novocain. The treatment used in the following case failed to prevent gangrene.

CASE REPORT

A seaman, first class, age 18 years, was admitted to the hospital 4 hours after he had been struck by a plane accidentally released by catapult on the flight deck of an aircraft carrier. The blow caused multiple fractures of the left arm, consisting of fracture of the lower third of the humerus, comminuted fracture of the upper third of the ulna, fracture of the lower third of the radius, and fracture of the navicularis.

When this patient was first seen he had extreme vascular impairment of the left arm. The hand was cold and pulseless, and the fingers were fixed in a claw-like position from which they were moved with considerable difficulty. It was thought that the pulseless extremity was the result of the fractured humerus causing an angulation of or pressure upon the brachial artery. Therefore a posterior splint which had been applied to bring the patient ashore was removed and the arm was placed in a relaxed position at the patient's side.

This maneuver caused no improvement in the circulation of the left arm. In fact, it was only after removing the splint that it was realized that the entire arm was cold and pulseless. The axillary and subclavian arteries on this side could not be palpated, although they were readily found on the right side. The left arm dangled, and cutaneous sensation was absent up to the region of the deltoid.

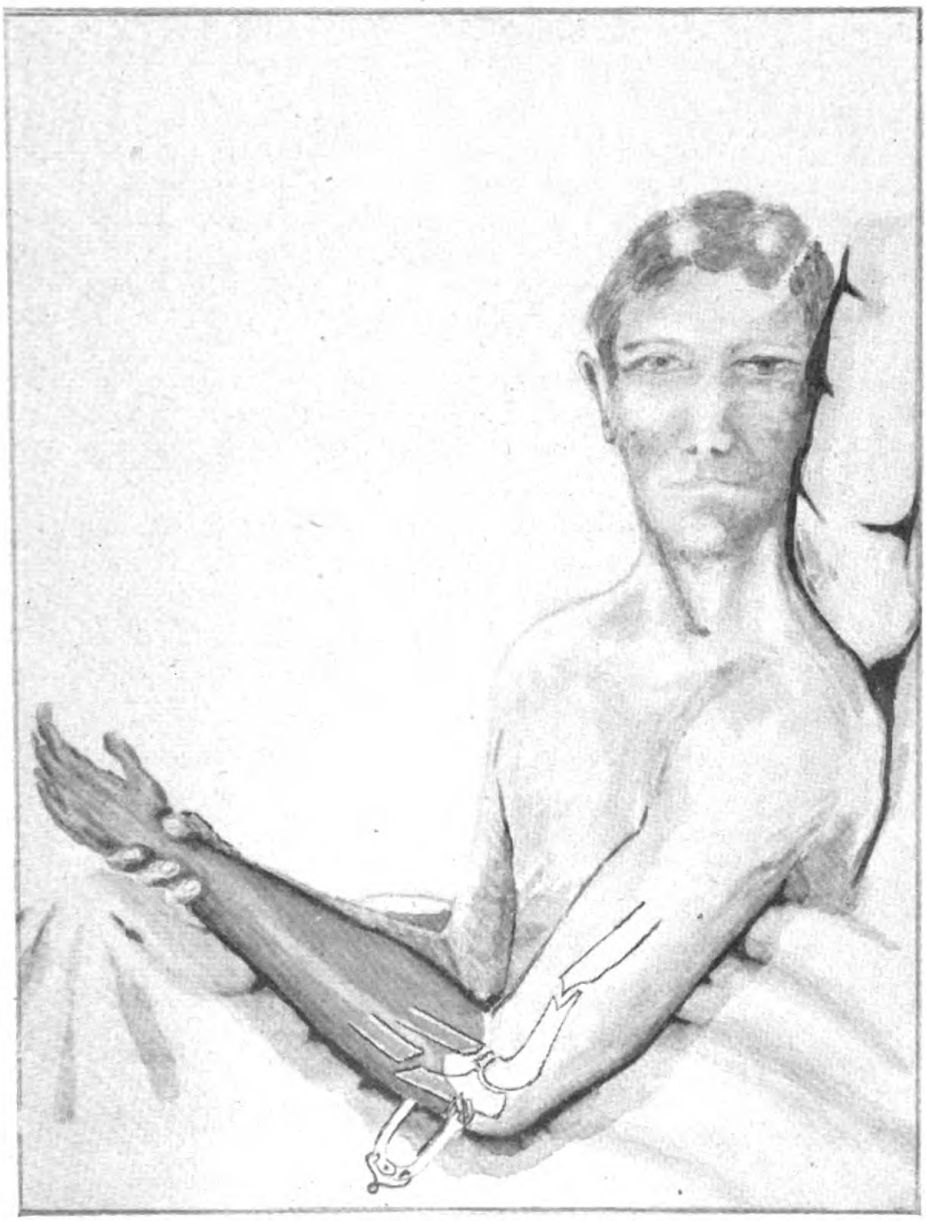
It was evident that there was severe injury to the brachial plexus, and the possibility of traumatic arterial spasm was considered in view of the pulseless subclavian artery.

The administration of papaverine was desired, but this drug was not available. Relaxed position of the extremity seemed to allow slight warming of the upper arm, and expectant treatment was given.

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Twelve hours later there was little change in the condition of the arm. The skin was warm to a point just below the deltoid region. Distal to this point the extremity was cold, pulseless, and somewhat swollen. The swelling was not marked, however, as might be expected in a venous thrombosis. At this time a slight subclavian pulse could be obtained. A definite Horner's syndrome was present which had been noted the previous evening but which had been interpreted then as an edema of the left eyelid as a result of the injury. Other physical findings were irrelevant as were the laboratory findings. Blood pressure readings on the right side were normal at all times.

It was decided to try to obtain a cervical sympathetic release by injecting the cervical ganglia with novocain. This was done with no apparent increase in the Horner's syndrome or improvement in the circulation of the extremity. The following day, however, there was an increase in the ptosis of the left eye and



1. Extent of gangrene, fractures, and ptosis of left eye is shown. Extent of damage to brachial plexis is unknown except that the entire left arm was paralyzed.

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the arm was warm down to the elbow. On the second day after admission a second cervical ganglion injection was done. This produced a definite flushing of the skin on the left half of the neck and face which sharply contrasted with beads of perspiration on the right side. However, no improvement in circulation of the left arm was noted.

In order to keep the arm in a more nearly anatomic position a Kirschner wire was placed through the lower portion of the olecranon, and traction was applied. In time the fingers and hand became more discolored. The fingers were rigid in the claw-like position, and the difficulty with which they were moved indicated irreparable damage to the muscles controlling their movements.

On the 4th day after admission a line of demarcation appeared below the elbow. This had extended practically to the elbow by the 6th day. Amputation was delayed in the hope that the elbow joint might be saved. On the 6th and 7th days the patient exhibited toxic absorptive symptoms, and amputation was performed on the 8th day after admission.

A simple guillotine amputation was done at the site of the fracture of the lower third of the humerus. No anesthesia of any kind was necessary. The vascularity was none too good even at this site and clearly indicated that an attempt at lower amputation would have failed. The brachial artery was found to be small and contracted. When it was cut a small stream of blood dribbled from its unclamped proximal end. No thrombosis was found in the artery nor was any found on subsequent dissection of the extremity or in the microscopic examination. The sections demonstrated various degrees of degeneration in the muscle tissue with congested blood vessels and moderate inflammatory response.

The patient received a blood transfusion of 500 cc. at the time of operation. He made an uneventful recovery and was discharged 6 weeks later. The Horner's syndrome became much less noticeable but still was present to a slight degree at the time of discharge.

This case is interpreted as one of traumatic arterial spasm resulting in gangrene of the left upper extremity. The cause of this extreme and protracted spasm is thought to have been a severe injury to the left brachial plexus and cervical sympathetic nervous system. The exact mechanism by which the cervical sympathetic control was removed, still allowing an extreme arterial spasm, is unknown. It is thought, however, that the stimulus caused by the brachial tear was so profound that it could not be overcome (as in Horner's syndrome) by the evident cervical sympathetic release.

Attention is called to the close similarity of traumatic arterial spasm and Volkmann's contracture. This is especially true of the foregoing case in which a typical Volkmann's contracture and paralysis had developed by the time the patient was first seen at this hospital.

That the majority of cases of Volkmann's ischemic paralysis are the result of arterial spasm caused by injury seems much more logical than the older view that these cases were caused by constricting bandages or splints on the elbow. Such constrictions or impinging bone ends may play a part in the Volkmann's picture but are secondary to the arterial spasm.

Leriche (*4*) is of this opinion and advocates early periarterial sympathectomy. This view is further substantiated by Barnes and

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Trueta (*5*) who produced muscular lesions in the legs of rabbits which were similar to those of Volkmann's contracture. This was done by means of a tight wire tourniquet left in place for about 4 hours. The arterial spasm which resulted from this stimulation lasted as long as 3 days. It affected collateral arteries as well as the main branch and at times caused spasm of the main artery of the opposite uninjured leg.

SUMMARY

Traumatic arterial spasm produces an easily recognized clinical picture of a pale, cold, pulseless extremity which often has very recently been traumatized by gunshot wound or fracture.

The actual lesion is a contraction of a main artery or its branches into cordlike, bloodless structures. This is brought about by direct or indirect sympathetic nervous stimulation. Varying degrees of ischemia result. The spasm may last for a few hours or for days.

Therapy is directed toward a release of the sympathetic nervous control of an artery. This includes reduction of a fracture and novocain injection into the arterial adventitia or the sympathetic ganglion. Papaverine is also administered as a vasodilator. The measures used in the case reported here failed to prevent gangrene of the upper extremity. While gangrene is not a frequent complication it was found in 9 of 52 cases reported in the literature.

The similarity between traumatic arterial spasm and Volkmann's ischemic paralysis is noted. It is suggested that many of the ischemic paralysis cases may have their origin in an arterial spasm.

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MANAGEMENT OF JAW FRACTURES COMPLICATED BY INTRACRANIAL INJURIES

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Of 20 jaw fractures handled by the dental department of this hospital in the past 6 months, 7 were complicated by intracranial injuries

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The mode of treatment of the jaw fracture was therefore modified. Symptoms of many intracranial injuries are frequently not obvious, and the patient may be examined by the dental officer before these injuries have been diagnosed. For this reason the dental officer should request the immediate collaboration of the neurosurgeon before selecting the anesthetic, sedative, type of appliance, time of reduction, and method of immobilization.

Moritz (*1*) has stated:

> It is not ordinarily appreciated how often severe and even fatal injuries are incurred without significant damage to the skin or subcutaneous tissues and without fracture of the cranium. A hat, cap, or heavy head of hair often affords sufficient protection to prevent external bruising. In about 25 percent of all cases of fatal craniocerebral injury, the skull escapes fracture.* * * Another important but frequently overlooked fact is that the impact responsible for a severe cerebral injury need not be applied directly to the skull. It may be applied to the chin, and be transmitted to the middle fossa by way of the mandible.

Garfin (*2*) found 8 percent of 4,100 patients with skull injuries treated in Boston City Hospital, to have complicating jaw injuries.

Of 10 survivors of aircraft crashes, admitted to this hospital in the past 6 months, 6 had intracranial injuries complicated by jaw fractures. Résumés of several of these cases are presented to illustrate the management of the fractures.

CASE REPORTS

Case 1.—An aviation cadet, age 19 years, was admitted to the hospital in an unconscious state following a plane crash. The diagnosis was intracranial injuries, and compound fractures, traumatic, of the mandible and maxilla. The maxilla was fractured transversely with the entire arch displaced downward and backward. The mandible was fractured bilaterally in the cuspid region. The chin was displaced 1 inch downward and backward. Cerebrospinal fluid leaked from the nose. Babinski's reflexes were present bilaterally. Lumbar puncture revealed increased spinal fluid pressure. X-ray findings are shown in figure 1.

Two days later the patient was still unconscious; the following day the cerebrospinal fluid was bloody, Cheyne-Stokes respirations were present and Jacksonian convulsions were exhibited, and on the 6th day the cerebrospinal fluid was xanthochromic. The patient was now conscious. Cerebrospinal fluid was draining from the nose. On the 12th day after injury, drainage of cerebrospinal fluid ceased, but 26 days after admission the patient still had to be restrained.

The attending neurosurgeon advised against treatment of the jaw fracture until 19 days after the accident occurred. At that time an arch bar was attached to the upper teeth and an external fixation appliance attached to the head by means of a plaster cast. This was accomplished under basal anesthesia induced by avertin, with the patient in a supine position. This application of the head cast was unsuccessful because of the irrational state of the patient while the plaster was hardening. The neurosurgeon advised further delay before attempting replacement.

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Ten days later, 3½ weeks after the accident, the head cast was replaced. A vitallium screw was then introduced into the inferior aspect of the chin in the depressed fragment, and arch bars were attached to the teeth of the individual mandibular fragments. This was accomplished under avertin anesthesia. Elastic traction was applied at four points to reduce the partially healed, malposed fragments: (1) Intermaxillary bands; (2) from the vitallium



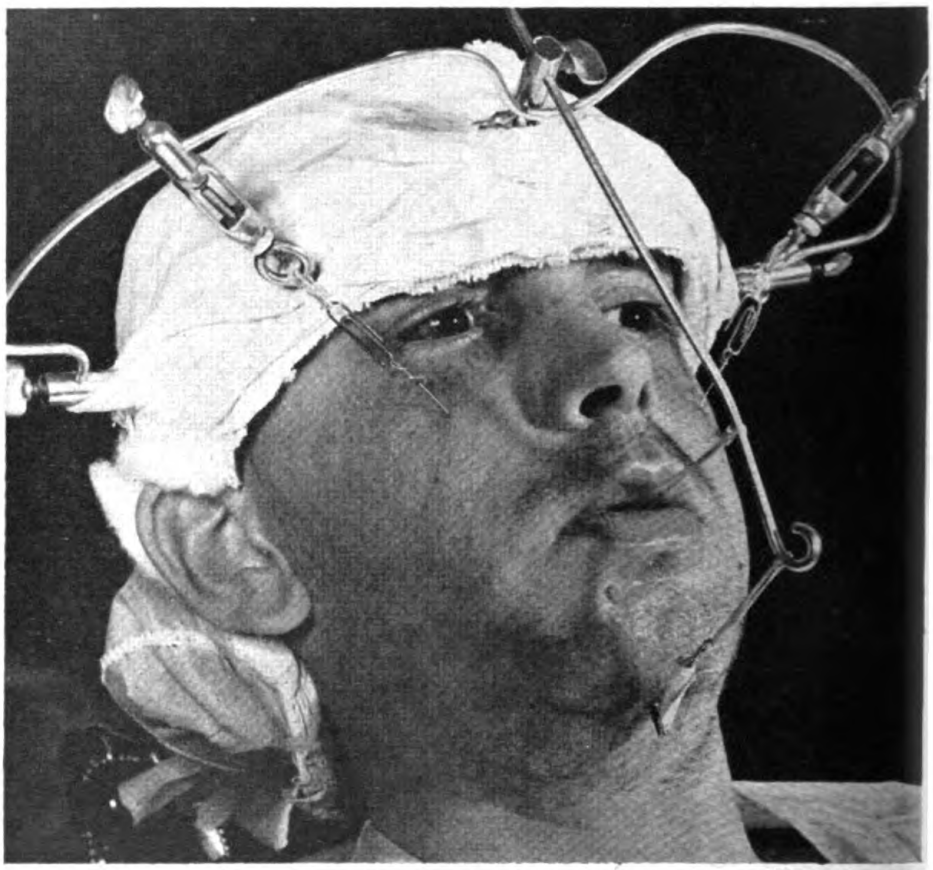
1. Case 1. Condition on admission.

screw in an upward and outward direction to the external fixation appliance; (3) from the arch bar attached to the teeth of the chin segment in the same direction; and (4) from the upper arch bar upward and outward to the external fixation appliance by means of wires through the cheeks (fig. 2).

The patient was discharged 3 months later with jaw fractures in good position. There was no permanent scarring from the wires through the cheeks, owing to the mobility of the points on the external fixation appliance.

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Case 2.—An aviation cadet, age 19 years, sustained multiple burns, intracranial injuries, and compound fractures of the maxilla and mandible in a plane crash. After a short period of unconsciousness following the crash, headache constituted the only symptom. Intracranial injury was apparently slight. The patient was burned on the left side of the face. There was a transverse fracture of the maxilla extending from tooth No. 8 to No. 13. Displacement was slight. The mandible was fractured at the left symphysis, angle, and both condyles. Displacement was extensive in all of these areas.



2. Case 1. Showing elastic traction applied at four points with external fixation appliance.

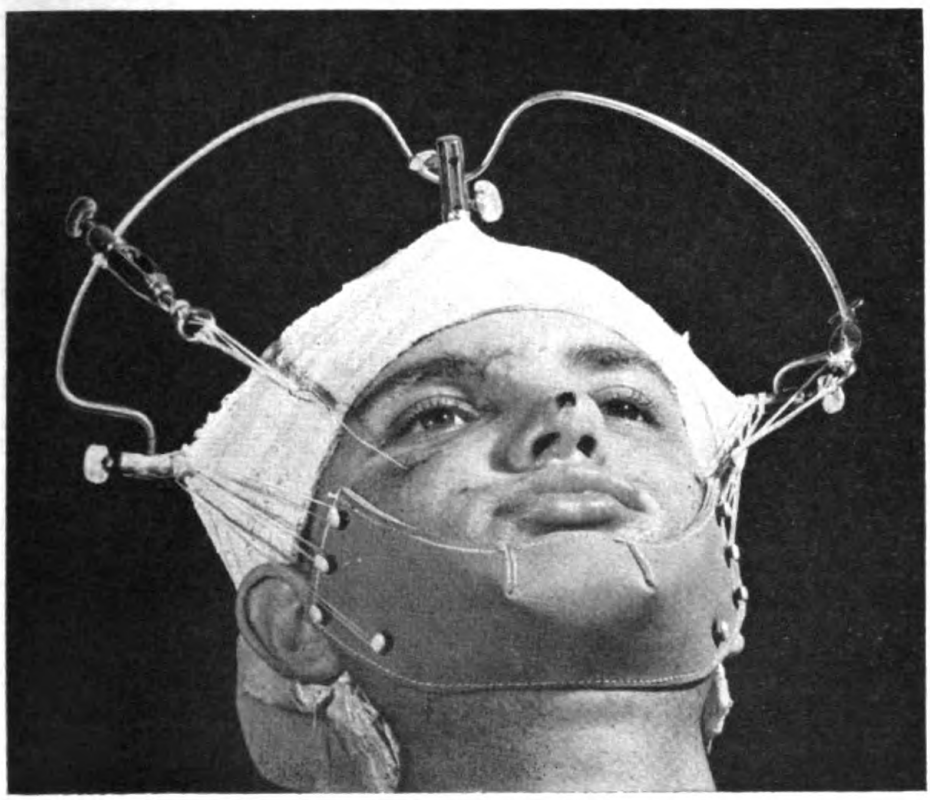
Reduction and immobilization were accomplished 4 days after admission. Avertin anesthesia was used, and reduction was effected by intermaxillary elastics attached to sectional arch bars and orthodontic bands fastened to the teeth in the usual manner. No attempt was made to reduce the fractures of the condyles. The immobilization devices were removed in 6 weeks, good results having been obtained.

Case 3.—An aviation cadet, age 21 years, was admitted to the hospital with intracranial injuries, and compound fracture, traumatic, of the maxilla, sustained in a plane crash. The patient remained unconscious for 18 hours. The maxilla was fractured transversely with the entire upper arch displaced downward and backward, and vertically through the central incisors, displacement amounting to one-fourth inch. The mandible was extensively comminuted on the left side, extending from tooth No. 26 to No. 31 inclusive. These teeth were removed.

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The patient was transferred to this hospital 10 days after injury, and the extent and severity of the intracranial injuries were partially determined at that time. Reduction procedures were instituted 2 weeks after injury. At that time the anterior teeth were wired together, reducing the vertical fracture of the maxilla.

An arch bar was wired at that time to the entire upper arch and an external fixation appliance was attached to the head by means of a plaster head cast. Traction was applied by wires through the cheek connecting the upper arch bar to the external fixation appliance. Segmented splints were attached to the remaining teeth in the lower arch. These splints were joined by intermaxillary elastics to the upper arch bar. A leather chin strap was attached to the external fixation device with elastic bands. The fractured jaws were successfully reduced and immobilized in this manner (fig. 3). The patient is awaiting prosthetic treatment at this time.



3. Case 3.

Case 4.—A Marine sergeant, age 21 years, sustained intracranial injuries and multiple compound fractures of the nasal and maxillary bones in a plane crash and was admitted to this hospital 1 month later. The patient had been unconscious after the crash. The nasal bone was fractured. The maxilla was fractured vertically in five distinct areas. The maxillary bones were also fractured transversely, the fracture line running through the orbit. Displacement of the upper arch was upward and backward, creating a telescoped effect. Intracranial injuries did not interfere with the treatment of the jaw fracture after 10 days. All the anterior teeth were fragmented.

Acrylic splints were fabricated and attached to the teeth on several fragments of the upper jaw. An arch bar was attached to the teeth on the mandible in

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the usual manner. Intermaxillary elastics were attached to the acrylic splints and the arch bar. The fractures were successfully immobilized in this manner.

DISCUSSION

The dental officer should possess a general knowledge of the symptoms of intracranial injury, particularly of the latent type, and should request consultation with the neurosurgeon at the earliest possible time in order to institute procedures of immobilization and reduction modified to coordinate with the patient's intracranial condition.

Morphine is contraindicated. The medullary depressant action masks symptoms of increasing intracranial compression.

Frequently patients suffering from intracranial injuries are irrational and noncooperative at the time of reduction and immobilization. The use of an anesthetic is indicated. Avertin is advocated as a basal anesthetic because it does not appreciably raise intracranial pressure. and provides adequate relaxation.

Ordinarily jaw fractures should be reduced as soon as possible, because organization proceeds to a considerable degree within 48 hours. Granular tissue is infiltrated with calcium salts derived from the autolyzed bone of the fracture site, and within 2 or 3 days the organized tissue sparsely unites the bone fragments and contiguous muscles and tissues. There is always a certain amount of fluid around the fracture site. The efficiency of cell proliferation and fibrin organization is indirectly proportionate to the amount of fluid transudate or exudate present. Late reduction (4 days for example) retards healing as the manipulation accompanying reduction stimulates the collection of fluid in the area.

Late reductions, even as late as 4 weeks (case 1) are frequently necessary in jaw fractures associated with intracranial injuries. These displaced fractures require definite and constant traction to effect reduction. Prefabrication of external fixation appliances is necessary.

Reduction of jaw fractures in the presence of intracranial injuries, or controversial intracranial injuries, should be undertaken while the patient is in a supine position, unless it is the opinion of the neurosurgeon that the patient may be treated in a sitting position.

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DIFFUSE SCLERODERMA

A CASE REPORT

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Following routine inoculations a recruit developed a diffuse scleroderma. Because of the unusual and previously unreported finding of a temporary reduction in the serum protein level during the early phase of the condition the case is believed worthy of review.

Reference to recent literature on this subject is interesting. Brock (*1*) in 1934 reviewed the reported cases, and found that 40 of 75 were fatal, with the higher mortality in the younger patient. He emphasized the fact that this condition not only involves the cutis and subcutis, but is primarily a disease of the connective and vascular tissues of the body, with frequent involvement of the musculature. The early course of the disease is marked by slight fever, general malaise, edema and erythema of the skin, and muscular pains and tenderness. He stated that histologic studies of the skin, subcutaneous tissue and muscle only add to the confusion of scleroderma of the diffuse type, with dermatomyositis.

In 1938 Sweitzer and Laymon (*2*) described causes of scleredema adultorum and thought that probably some cases of early diffuse scleroderma would be confused with this entity. Scleredema appears after an acute infectious process, fades without sequelae, usually within 18 months, and never affects the hands or feet.

In 1940 Dowling (*3*) expressed the opinion, undoubtedly held by others, that diffuse, progressive scleroderma and dermatomyositis are the same disease.

CASE REPORT

The patient, 21 years of age, developed stiffness and swelling of the skin of his hands, arms, trunk, legs, feet, and finally the face, beginning a few days after the last of the usual injections received by recruits. His health record indicated that he received cowpox vaccination, 3 typhoid and paratyphoid injections, alum precipitated tetanus toxoid, and yellow fever vaccine. He felt feverish and generally fatigued during the onset of the above symptoms, and noted that the stiffness and swelling of the skin were worse after resting or sleeping. The family history suggests that his father had a similar condition. The physical examination on admission to the hospital showed a diffuse, firm, painless, nonpitting edema of the face, neck, trunk, arms and legs, including the hands and feet. The superficial veins had channelized the skin, particularly of the forearms. The swelling of the skin appeared to limit joint motion. Typical urticarial wheals were observed during the early period of observation. The blood pressure was 120/60.

Extensive laboratory and clinical examinations showed a persistent eosinophilia of about 10 percent; a basal metabolic rate of plus 36 percent; a low serum protein level of 5.4 percent, which rose to a normal 8.5 percent in 2 months; and a sedimentation rate of 5 mm. in 15 minutes and 24 mm. in 60

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minutes. The blood cholesterol was 238 mg. percent. A biopsy showed findings consistent with scleroderma in the cutis, subcutis, and striate muscle. A lymph node showed inflammatory hyperplasia. The carbon dioxide combining power of the blood was 50-volumes percent, the blood calcium was 8.1 mg. and the albumin-globulin ratio was 1:1.72. X-ray examinations showed a minimal degree of osteoporosis of the bones of the hands, but not of the legs or lower extremities.

Plasma was administered on two occasions with a temporary aggravation of the clinical condition but with marked subjective improvement, and a return of the serum protein level to normal values. Both symptomatic and dietary treatment was ineffective in altering the course of the condition. The patient could be kept comfortable by means of daily Hubbard baths and deep massage. He was placed under treatment with sulfathiazole, 4 gm. daily, with a temporary clinical improvement, but the drug was discontinued after 3 weeks, since no further response was apparent. The patient was invalided from the service in a static stage of his disease with an unfavorable prognosis.

DISCUSSION

There were many features of this case which made the diagnosis of diffuse scleroderma rather certain, except for the temporary lowering of the serum protein level, and the low albumin-globulin ratio. The low calcium value did not agree with the usual finding in scleroderma. The elevated basal metabolic rate has been reported so frequently that Leriche and others (*4*) thought that the condition was a form of hyperthyroidism, and have endeavored to prove this by rat experiments. However this finding is so commonly found in widespread dermatoses that it is best considered an incidental finding rather than of etiologic importance. Cautious thyroid medication did not apparently harm the patient but was discarded as ineffective. The meaning of the slight improvement under sulfathiazole therapy is not known. Its use was justified on the basis of a moderate and persistent leukocytosis, and the altered sedimentation rate.

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SKIN PIGMENTATION FOLLOWING SULFONAMIDE THERAPY

REPORT OF A CASE

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It has been several years since prontosil and sulfanilamide were proved effective therapy in hemolytic streptococcus infections. Since that time a number of sulfonamide derivatives have been introduced which have proved to be highly effective against a wide variety of organisms. The exact mode of action of the sulfonamide group is not as yet thoroughly understood; that in some manner it attacks the growth-inhibiting properties of the organism is generally agreed.

It was observed early in the use of the sulfonamides that toxic reactions occurred in some individuals. Skin manifestations of toxicity are manifold, but fortunately most of them are not severe. The incidence of sensitivity as manifested by skin reactions in cases receiving sulfonamide therapy is estimated at 5 percent.

The milder, less severe types of reaction most commonly seen can be described as morbilliform, scarlatiniform, or nodosal in type. Reactions may occur at any time after the drug has been started and their severity appears to be directly related to the degree of congenital or acquired sensitivity.

The present case exhibits a severe toxic reaction, that of exfoliative dermatitis and associated acute serum-like reaction followed by pronounced pigmentation of the skin.

CASE REPORT

A 25-year-old seaman, first class, was transferred to this hospital with a tentative diagnosis of measles coincident with a gonorrheal urethritis. He had been receiving sulfathiazole, 1 gm. every 4 hours, day and night during a 10-day period for a total of 60 gm.

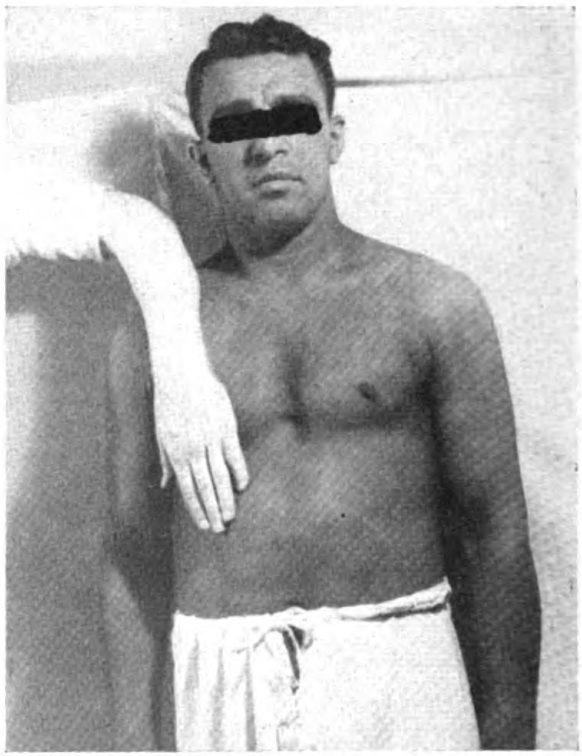
On examination there was a generalized morbilliform eruption which was considered to result from sulfathiazole sensitivity. The urethral discharge was positive for gonococci. Results of physical examination were otherwise entirely negative. The family history revealed that among seven siblings, one brother was consistently subject to attacks of hives upon eating strawberries, and another brother had had infantile eczema. The patient gave no history of allergy in himself.

He was admitted to the venereal disease ward and started on potassium permanganate irrigations without any sulfa-medication. At this time, the leukocyte count was 12,450. The blood Kahn test was negative, but the urethral smear was positive for gonococci. Two days later the skin eruption had disappeared.

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Eleven days after admission, because of the persistence of a urethral discharge containing gonococcus, the patient was given sulfapyridine 1 gm. twice a day for 3 weeks. At the end of that time the drug was discontinued (a total of 46 gm. having been administered) because of headache, sore mouth, a generalized scarlatiniform eruption, severe conjunctivitis on the exposed portion of the sclerae, and a temperature of 102° F. The leukocyte count at this time was 18,450 with a normal differential. Within the next 24 hours the patient developed severe pruritus, dyspnea and a generalized edema, which was especially marked about the face, neck, head, hands, and feet. The skin was violescent. The temperature was 104° F. and pulse rate 120. The patient was moderately irrational and disoriented. At this time his condition was considered to be critical.

Dermatologic consultation was called and the opinion was given that the skin eruption and the systemic manifestations were on the basis of sulfonamide sensitivity. Empirical treatment was given consisting of epinephrine whenever necessary, potassium chloride, moist boric acid dressings, and parenteral fluids.



1. Photograph of the patient 3 months after the acute episode.

The edema, dyspnea and fever gradually subsided during the next 10 days; however 13 days following the acute episode the patient developed pronounced tympanitis which required prostigmine and enemas for relief.

On the 7th day after the acute reaction, a generalized marked exfoliation of the skin appeared, along with a progressive increase in the previously noted violescent skin pigmentation.

This pigmentation progressed in intensity, losing its violet tinge and taking on the chocolate color of Negroid skin. The skin remained this color for the next 2 months and then very gradually began to fade. Figure 1 shows the patient 3 months after the acute episode. Along with skin exfoliation there was loss of hair on the head and in the axillae and transverse furrowing of the nails of the hands

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and feet. On discharge to duty after 5 months of hospitalization the only remaining manifestations were a moderate degree of skin pigmentation with thinning of the hair and transverse furrowing of the nails.

Laboratory studies during the period of hospitalization consisted of skin biopsies which showed melanin as the source of the pigmentation. Blood chemistry studies showed the nonprotein nitrogen to be 26 mg. percent after 1 month of hospitalization and 39.1 mg. percent 2 months later, with sodium chloride 363 mg. percent, total protein 7.8 gm. percent with albumin 5.7 gm. and globulin 2.1 gm. A glucose tolerance test was within normal limits. In the 4th month of hospitalization the ketosteroid level was 18.7 mg. in 24 hours. The urine tended to darken on standing, but the pigment was not definitely established. In the 5th month a modified Prausnitz-Küstner (*1*) test was done by injecting the patient's serum intradermally into 3 patients who were receiving sulfonamides at the time, but no reaction was noted at the site.

COMMENT

Complications, such as in the case reported, occurring during the treatment of gonorrheal urethritis constitute obviously a sulfonamide reaction. The simplest explanation is that sensitivity to sulfathiazole developed during the initial period of administration of the drug and finally became manifest in the form of a morbilliform eruption at the end of 10 days. The optimal time to develop sensitivity is 7 days (*2*). However, the etiology of the reaction in this case is problematical. After a 10-day rest from the sulfonamides the patient was given small doses of sulfapyridine for 3 weeks. This treatment was discontinued because he suddenly developed angioneurotic edema, a scarlatiniform eruption, fever, etc. The latter reaction may have resulted from one or more of the following:

1. An allergic sensitivity to the sulfapyridine alone may have developed during the 3 weeks on this drug, which is ample time to acquire this sensitivity, and the severity of the reaction may be attributed in part to the patient's susceptibility to sulfonamides, as manifested by his earlier cutaneous reaction.

2. The symptomatology could fit the pattern of a toxo-allergic syndrome in which the prolonged administration of the drug has an overwhelming effect on the detoxifying mechanism, at the same time producing an acquired hypersensitivity of the skin, both acting synergistically to effect the final acute reaction (*3*).

3. There is the possibility that sulfathiazole was administered by mistake just prior to the acute episode, since most of the patients in the ward were receiving this drug. If that were the case this was a true allergic reaction to sulfathiazole and fits most of the facts already known about the reaction produced by readministration of the same sulfa drug, even to the increased severity of the second reaction. In this sense the reaction could be classified clinically as anaphylactoid.

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The delayed or late complications; that is, the exfoliative dermatitis and the skin pigmentation, are even more difficult to explain. The unusual skin pigmentation was the most unique single finding in this case. No similar cases of severe skin pigmentation following sulfonamide reactions could be found in the literature, although skin pigmentation of this type is occasionally seen in arsenical reactions.

Because the pigment was definitely established to be melanin, the role of the adrenal glands was considered. The pigmentation seen in Addison's disease is not unlike that of this patient, except that in our patient the pigment was of a much heavier intensity and tended to be generalized rather than localized to the exposed parts and pressure-points. The idea was entertained that the entire picture of the anaphylactoid reaction and pigmentation might be explained on the basis of acute adrenal failure, but some of the other signs of adrenal secretion deficiency were notably absent. In fact potassium salts were administered (upon the rationale that the reaction was largely allergic) without any apparent detrimental effects, and only insignificant amounts of sodium chloride were given in the parenteral fluids. The ketosteroids were determined too late in the convalescence to be of significance in attributing the cause of the illness to adrenal failure.

There is a temptation to ascribe the mechanism of the pigmentation to the hypothesis that dioxyphenylalanine is the precursor of both melanin and adrenin, and that during the acute adrenal failure adrenin production had diminished or ceased, thus leaving excess dioxyphenylalanine to be entirely converted to melanin.

Because of the generalized, intense, and persistent nature of the pigmentation, the possibility of a peripheral circulatory imbalance seemed reasonable.

The actual stages in the formation of melanin in the skin are not clearly defined, with many differences of opinion among the investigators. However, there are certain features which are generally agreed upon, namely: (1) That melanin is a protein pigment of unknown structure closely related to tyrosine and other amino-acids (*4*). (2) That dioxyphenylalanine is a chromogen closely related to tyrosine and adrenin (*4*). (3) That the pigment forming oxidase in the melanoblasts converts dioxyphenylalanine into melanin, but not into tyrosine or adrenin (*4*). (4) That by inference dioxyphenylalanine, or a substance similar to it, is the mother substance of melanin (and perhaps adrenin), the conversion to melanin occurring in the skin through the mediation of a specific oxidase elaborated by the melanoblasts in the skin. Since the ferment system functions entirely in the skin layers themselves, it is quite in order to expect that alteration in the physiologic processes of melanin-conversion also occurs.

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That a deep brown pigmentation of the skin follows exposure to ultraviolet rays in some patients treated with the sulfonamides has been observed by clinicians. Similar findings on exposure to x-rays also have been recorded. In addition, the numerous reports of cutaneous eruptions to be found in the literature all attest that the skin is altered in some way in a certain number of persons receiving sulfonamide therapy. The actual pathologic physiology of this hyperpigmentation is not understood, but the possibilities of fruitful research in this direction are apparent. The question is raised whether the oxidation products of the sulfonamides could have escaped liver detoxification and affected the pigment metabolism in the skin.

Many of these skin reactions may be prevented by observing the following precautions:

1. Close questioning of the patient as to use of these drugs in both the distant and immediate past; the presence of any skin eruption and its nature; a family history or personal history of allergy, drug, and sera reactions.

2. Avoidance of sunlight, sun lamps and x-rays while the patient is receiving sulfonamides.

3. Frequent examinations of the blood should be made during chemotherapy.

4. No other drugs, especially those known to produce reactions, should be administered in conjunction with sulfonamides.

5. Minor infections should not be treated with the sulfonamides, either locally or orally, because of the danger of engendering sensitivity.

SUMMARY

1. A case of sulfonamide sensitivity with acute serum-like reaction, exfoliative dermatitis and deep skin pigmentation is presented. The pigment responsible for the hyperpigmentation was found to be melanin.

2. The sulfonamides produce skin eruptions in approximately 5 percent of cases in which the drug is used.

3. Many of these skin reactions are severe; they may be exfoliative or multiform in character and may be associated with severe serum-like disease, or shock type of reactions which may result in death.

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GUNSHOT WOUND OF THE ABDOMEN

REPORT OF A CASE

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The extensive damage to the abdominal viscera caused by a pistol shot, the unusual circumstances associated with the shooting and the radical surgery accomplished under limited facilities, make the following case worth reporting.

CASE REPORT

The patient while on shore patrol was sitting in a cafe when he discovered his pistol was missing from its holster. As he turned around to inquire he was shot in the left flank. A doctor was called who gave first aid consisting of dressing the wounds and administering ½ grain of morphine tartrate. The patient was placed in an ambulance and sent to the field hospital, a distance of about 26 miles.

On arrival at the field hospital about 2 hours after the shooting, the patient was in fairly good condition, pulse 120, blood pressure 130/70, and there was pain and definite rigidity of the entire abdomen. A small wound was present on the lateral aspect of the left flank and another on the lateral aspect of the right thigh. There was a superficial abrasion over the right inguinal ligament with purplish discoloration; apparently the bullet had approached the surface, deflected and emerged from the lateral aspect of the thigh. There was little bleeding from the wounds.

The abdomen was prepared for operation immediately and the preoperative medication of ¼ grain of morphine sulfate given. Under ether inhalation anesthesia the abdomen was opened and a large amount of bright red blood gushed from the wound. Digital compression was made on the abdominal aorta and the small bowel was rapidly brought out of the abdomen. The bleeding was controlled and its origin observed as being the many wounds in the bowel and mesentery. The patient was quite cyanotic and his pulse thready. After exploring the small bowel it was found necessary to resect 4 separate segments, each from 4 to 6 inches long and each segment separated by a distance of approximately 12 to 16 inches. The bowel at these points was so badly damaged that the entire circumference was destroyed. These segments were resected and the continuity reestablished by end-to-end anastomoses, the bowel ends being sectioned somewhat obliquely so as to allow for a larger stoma. Three other openings were closed transversely and many rents in the mesentery were sutured. The bowel was replaced and about 8 gm. of sulfanilamide powder dusted into the abdominal cavity. The abdomen was closed without drainage.

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During the operation the patient was given 1,500 cc. of plasma and 500 cc. of whole blood. His blood pressure ranged between 100/60 and 130/80. However the pulse rate was rapid and very thready and cyanosis with shallow respirations was apparent throughout the operation. The prognosis was grave.

On return to the ward his condition remained only fair. Another 500 cc. of whole blood was administered. The following day his condition seemed to be much improved and another 500 cc. of blood was given. He received 3,000 cc. of fluid daily, intravenously, until the fifth postoperative day when fluids were begun orally. Sulfathiazole 30 grains was instilled rectally every 4 hours until the fifth day when he was able to retain it orally. The dose was then cut to 15 grains every 4 hours.

A large amount of foul-smelling pus began to drain from the right groin about the fifth postoperative day. On the ninth postoperative day the patient was found to have a partial evisceration and the lower 4 inches of the wound were reclosed with through-and-through catgut sutures. During this procedure a considerable amount of purulent material suddenly flooded the wound, coming from the pelvis. A drain was inserted.

Convalescence was uneventful and on the 27th day the patient was sitting up, eating a normal diet. Evacuations were normal.

COMMENT

After transportation over a very rough road for a distance of 26 miles this patient withstood the resection of four separate segments of small bowel and the closure of three perforations in the bowel and many perforations in the mesentery. We feel that a large factor in his survival was the administration of large amounts of plasma and whole blood, both during and after the operation, plus the liberal use of the sulfonamides both intraperitoneally and parenterally. Another fortunate circumstance was the fact that the large bowel was not perforated, although the last resection was done near the ileocecal valve. Another feature worthy of note is the tremendous amount of damage encountered within the abdomen while both the wounds of entrance and exit were small.

This case is also particularly interesting because it reveals what can be done in a field hospital where the facilities are limited. Chromic No. 00 catgut on an ordinary needle was used for the anastomoses. Ordinary hemostats were used instead of bowel clamps, the gut sectioned and digital compression employed to prevent bowel content leakage. A Wangensteen suction apparatus was improvised from an ordinary Rehfuss tube with the olive removed. Excellent nursing care was given by the hospital corpsmen and much credit is due them for bringing this case to a successful conclusion.

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PILONIDAL CYST

TREATMENT AND CURE AFLOAT

PHILIP S. BARBER
Lieutenant Commander (MC) U. S. N. R.
and
HUBERT McN. POTEAT, JR.
Lieutenant (MC) U. S. N.

The 10 cases of pilonidal cysts to be reported here include varying degrees of pathologic processes from quiescent tumors to grossly infected and even suppurative abscesses. All, however, have been treated along the same lines with very gratifying results.

Elective surgery aboard a warship in the war zone may be open to criticism and a word of explanation seems necessary. The following considerations, however, influenced the resort to surgery:

1. Extreme care in selecting the time of operation was taken so that the patient's period of inactivity would not fall during a time when action with the enemy was imminent.
2. The pain, discomfort and incapacity of the individual made surgery almost compulsory.
3. Naval hospitals were not always immediately accessible.
4. Because of the movements of the ship there was small likelihood that a man would be returned to this command if he were transferred to a hospital.

TABLE 1.—*Details of operative cases*

Patient	Rate or rank	Age	Condition upon reporting	Preoperative therapy	Operation	Sick days
1	MM2c	18	Quiescent	Sulfathiazole by mouth	Complete excision	14
2	S1c	19	do	do	do	14
3	S2c	22	Suppurative	Incision and drainage of abscess plus sulfathiazole.	do	20
4	Cox	22	do	do	do	15
5	MM2c	21	do	do	do	15
6	RdM3c	19	Quiescent	Sulfathiazole by mouth	do	12
7	Ensign	25	do	do	do	25
8	SF1c	21	do	do	do	12
9	BM2c	20	do	do	do	12
10	SC2c	20	Suppurative	Incision and drainage of abscess plus sulfathiazole.	do	15

The surgical technic was approximately the same for all cases. At the time of excision, all cysts were quiescent. Table 1 lists the cases individually and give some idea as to the age of the patients, the varying nature of the cysts and total sick days. When a localized, fluctuant mass was found either in the midline or pointing in one or the other buttock, the abscess was incised and drained under novocain or occasionally sodium pentothal anesthesia. Following the incision and drainage, it has been our custom to return the men to duty

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status, having them report to the sickbay daily for dressings. When the purulent discharge has ceased, the inflammatory process subsided, and all major subjective symptoms have abated (usually in 7 to 14 days) the patient is admitted to the sick list and surgery carried out.

Twenty-four hours prior to operation 8 gm. of sulfathiazole is administered by mouth in 2-gm. doses every 6 hours. An enema is given and full preparation of the buttocks is done, and sodium amytal, grains 3, is given at bedtime the night prior to operation.

On the morning of the operation, ¼ grain of morphine sulfate, and 1/150 grain of scopolamine hydrobromide, are given hypodermically 1 hour prior to operation, and 100 mg. novocain anesthetic (intraspinal) is used. With the patient face down on the operating table, the buttocks are pulled apart by means of modified Montgomery tapes which are fastened to the underside of the table. Wide excision of the teratoma is then done, removing as much of the buttocks on either side as is necessary and excising down to the sacrum.

After carefully dissecting out all the sinus tract and securing absolute hemostasis, the edges of the wound are undermined about 1 inch below the skin surface and all bleeding from this process is controlled. Sulfanilamide crystals (the amount varying from 2 to 5 gm.) are then gently but thoroughly massaged into the surrounding tissue. This massaging is done thoroughly so as to insure the complete mixing of the crystals with the serum and to insure an adequate dispersion of the drug for its maximum benefit. Simply pouring the drug into the wound is unsatisfactory because it does not completely cover the wound and is more likely to cake. For this reason also, we prefer the crystals to the powder form. Four or five interrupted plain catgut sutures are now placed through the undermined tissue of the buttocks and through the fascia on the dorsal surface of the sacrum so as to obliterate any and all dead space at the base of the wound. Interrupted mattress sutures (linen or silk) are used to close the wound. These extend down so as to overlap the subcutaneous sutures and thus further obliterate any dead space near the center of the wound.

Following operation the patient is told to change position in bed only when assisted by a corpsman; morphine sulfate is used freely to insure this end. Sulfathiazole, 8 gm., is administered during the first 24 hours; this dosage is decreased to 6 gm. daily for 3 days, and then 2 gm. daily for the next 3 days. Sulfathiazole blood level determinations are not made aboard ship; therefore, a very close watch is maintained on the daily blood counts, urinalyses, and subjective signs of toxicity. There were no untoward symptoms in this series.

The original dressing is left in place for 8 days unless complications arise. At the end of this time the dermal sutures are removed and the

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patient is allowed to be up on the 10th postoperative day. By the 14th to 20th day he is returned to a light duty status and kept under observation. Nine patients in this series have returned to their stations and their wounds were completely healed within 1 month after operation. The one case which failed to heal immediately was that of a patient who got out of his bunk on the 3d postoperative day and went to the wardroom, where he received a blow on the buttocks. As a result, the lower one half of his wound broke down, and even though he was back on a duty status in 25 days, the wound did not completely close for another 2 months. Categorically, this cyst was the smallest and most unpretentious of the entire series.

There have been no recurrences in any of our cases which have been observed for periods varying from 2 to 22 months.

CASE REPORTS

Case 1.—A machinist's mate, second class, age 21 years, complained of throbbing pain between the buttocks and above the anus. He stated that about 8 months ago he had had a large rectal abscess incised and drained. For the past 2 years he had intermittent attacks of pain in the area which would last for 2 or 3 days followed by a foul-smelling discharge. The discomfort was not extreme and he sought no medical attention until 8 months ago when the abscess was drained.

Examination of the area at this time revealed a fluctuant abscess about ¼-inch in diameter, pointing through the right buttock about 2 inches from the midline. The surrounding skin was acutely inflamed, reddened, tender, and swollen. In the midline there were 4 small openings which admitted a fine probe for a distance of about 2½ inches in each direction. An indurated mass to the left of the midline was resistant to the probe.

Using novocain anesthesia the abscess was incised, and a large amount of foul-smelling, thick pus exuded. A rubber tissue-drain was inserted and the patient was instructed to take two sitz baths that day and report to sickbay the following morning. The next day all subjective symptoms had abated but frank pus was still present. For the next 7 days the man took hot sitz baths twice a day and the inflammatory process subsided to such an extent that he was considered ready for surgery. However, it was necessary to wait 2 weeks before operating because of the disposition of the ship.

Upon operation the abscess cavity in the right buttock was found to be about 1½ inches in diameter with sinuses extending about 2½ inches out into the buttock; on the left side a smaller sinus tract was dissected about 1 inch from the midline as well as a third tract which extended downward into the midline to the sacrum. Sulfanilamide crystals, 5 gm., were then gently massaged into the wound, and closure was effected as previously described. Sulfathiazole therapy was continued postoperatively. The dermal sutures were removed on the 8th postoperative day, and the wound was found to have completely closed. The man was up and about on the 10th postoperative day and returned to duty status on the 15th postoperative day, completely healed.

Case 2.—A radarman, third class, age 19 years, complained of discomfort at the base of the spine. He stated that for the past 6 months he had occasionally noticed the same type of pain but never had sought medical aid. The discomfort never was severe, and there had been no noticeable discharge.

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Examination revealed a reddened, tender, painful mass in the midline over the sacrum. Two openings were found which admitted a small probe. The depth of the sinus tract appeared to be about 2 inches. No tract could be found laterally; however, the whole area was indurated and tender for about 1½ inches on each side of the midline. Following preparation as described, operation was performed.

At operation the main sinus tract was found to be in the midline, 3 inches long, and extended down to the sacrum. Small sacs were found laterally. The entire mass was excised. Sulfanilamide crystals were massaged into the remaining tissue and the postoperative routine carried out as previously described. On the 8th postoperative day, after an uneventful convalescence, the dermal sutures were removed, and the wound found to be completely healed. The patient was up and about on the 10th day and back to a duty status on the 12th postoperative day.

SUMMARY

1. A series of 10 cases of pilonidal cysts is reported. The complete radical excision of the sinus tract is advocated.

2. The preoperative and postoperative use of massive doses of sulfathiazole in this series markedly reduced the morbidity.

3. The massaging of sulfanilamide crystals into the tissue, and the use of subcutaneous interrupted catgut sutures to obliterate all dead space, to provide firm healing and to insure absence of serum pockets, are essential points in the operative technic.

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OBSERVATIONS UPON THE APPARENT INCREASED INCIDENCE OF CENTRAL RETINO-CHOROIDITIS

The pathologic picture varies from a faint stippling of the macular area, with little if any lowering of visual acuity, to a definite "hole in the macula" with edema and 50 percent or more loss of vision. Occasionally there is a definite degeneration with patchy exudate and pigmentary deposits. Quite frequently the condition is unilateral.

Occurring in a group of young individuals who are supposedly fit at the time of enlistment or commission and whose vision is recorded as normal in their health records, it excites interest as to the probable etiology.

Various etiologic factors have been considered: Syphilis, tuberculosis, focal infection, vascular spasm, allergy and phototraumatism.

In the cases I have seen, syphilis has not been a factor. Tuberculosis has been ruled out clinically, confirmed in some cases by x-ray of the chest. Mantoux tests were done in a few cases and were negative or mildly positive, as one would find in an average group. I have not been able definitely to attribute the condition to a focus of infection.

The macular tissue is easily injured by vessel disturbances, both because of the fine vessels supplying this area and because of the

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highly sensitive type of nerve tissue there. Even temporary narrowing of retinal capillaries can cause considerable and permanent damage. I am aware that some investigators have established reasonable arguments that there is an actual angioneurotic constitutional peculiarity with reference to retinal capillary spasm, analogous to migraine and intermittent claudication.

I feel quite sure that migraine is due to spastic narrowing of certain vessels in the brain, but the precipitating factor, or "trigger," is not always readily apparent. It seems to me to be quite logical to assume that psychic trauma induced by fear, worry, and shock of war duty, especially in an individual with the hereditary angioneurotic constitutional make-up, may easily produce capillary spasm and thus initiate degenerative changes in the macular area. An edema of the subretinal tissues is produced and the stippling which appears later is an infiltration of the external retinal layers. The spasm also probably involves the underlying choroidal vessels.

The fact that the lesions seem to occur during the summer or in hot tropical climates speaks for a possible allergy (pollen sensitivity). On the other hand, in this same geographical area, the retina is exposed to a tremendous amount of actinic insult.

All ophthalmologists have observed the marked edema of the retina which results from exposure, for even a very short time, to the electric welder's "flash." It does not seem illogical that continuous phototraumatism of intense sunlight may produce similar pathological conditions. I suggest that a combination of capillary spasm plus phototraumatism could produce the pathology under discussion, and account for its unilateral tendency.—Commander C. E. HARNER (MC) USNR. Staff Conference, U. S. Naval Hospital, Pearl Harbor, T. H.

GRAMICIDIN AND PENICILLIN

Gramicidin is a highly effective antibacterial substance for most gram-positive pathogens. It is considerably less toxic for tissues than most germicides in use at present. Gramicidin behaves like an anionic detergent and is hemolytic. For this reason its clinical use is restricted to local application and to implanting it into infected cavities.

Penicillin is also a highly effective antibacterial agent against a variety of pathogenic organisms. Penicillin is even less toxic for tissues than gramicidin. Penicillin does not behave as a detergent-like substance and is not hemolytic. Penicillin may be administered locally, subcutaneously, intramuscularly or intravenously without evidence of toxicity. Penicillin should prove of great value in the treatment of severe infections. In using penicillin the principles concerned with its somewhat selective antibacterial activity should be adhered to strictly. Neither gramicidin nor penicillin can be substituted for sound medical and surgical judgment so essential in the management of bacterial infections.—HERRELL, W. E.: Gramicidin and penicillin. S. Clin. North America **23**: 1163–1176, August 1943.

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MEDICAL AND SURGICAL DEVICES

DESIGN FOR AN X-RAY DEPARTMENT AT AN ADVANCE BASE HOSPITAL

JOHN W. OLDS
Lieutenant (MC) U. S. N. R.

The demands made upon the x-ray department of an advance base hospital require a degree of flexibility in the employment of personnel and equipment which can be achieved only through careful planning. One such department was established under something less than ideal conditions and later a second department built under circumstances considerably more favorable. Previous experience proved invaluable in the latter instance, and in this communication the primary purpose is to show, by means of photographs, an arrangement of equipment which has provided the flexibility required. With the possible exception of the floor plan (fig. 1) and adaptation of equipment to a 20- by 48-foot steel hut (fig. 2), no originality whatever is claimed. It would be gratifying if the experience should prove useful to others in the establishment of similar departments elsewhere.

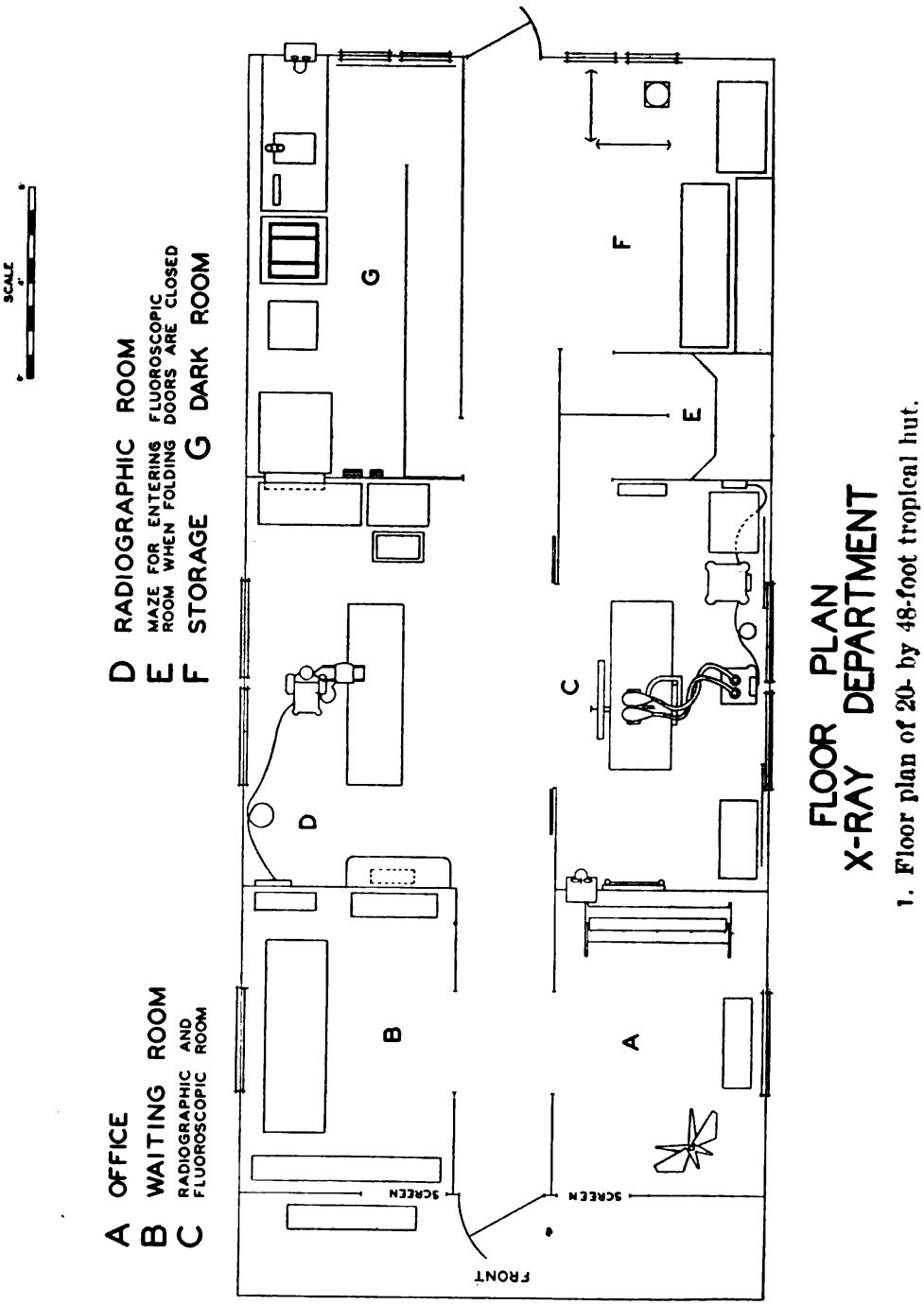
OFFICE

The space provided for an office (fig. 3) serves as a general film reading room. The four-panel viewing box is provided with fluorescent lamps. A 50–watt lamp set in the bottom of a discarded plasma can serves as an illuminator for dark areas of the roentgenograms. A Stanford stereoscope serves as an accessory viewing box. The bulkheads which separate the office from the central corridor, and the waiting room from the corridor and general x-ray room, are only 6½ feet high and are open to a height of 18 inches above the deck.

WAITING ROOM

Directly opposite the office is a waiting room (fig. 4) containing benches as shown in the diagram. Magazines are provided, and a large comprehensive map of the world pinned to the bulkhead helps to

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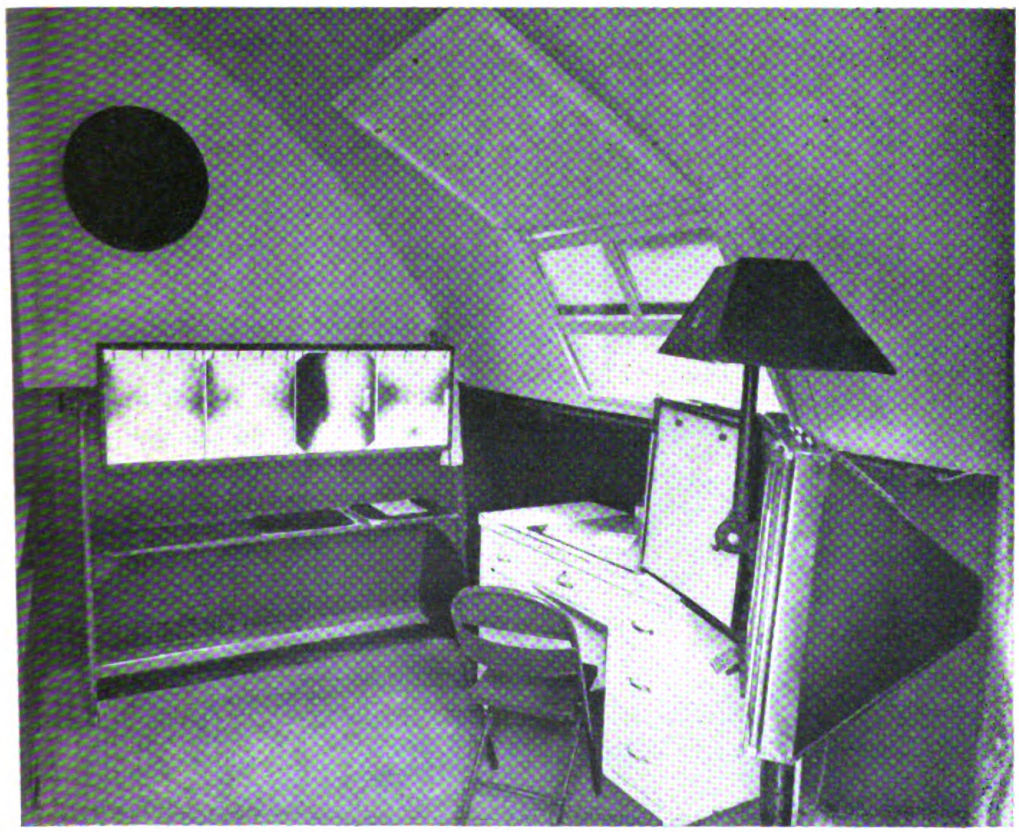


1. Floor plan of 20- by 48-foot tropical hut.

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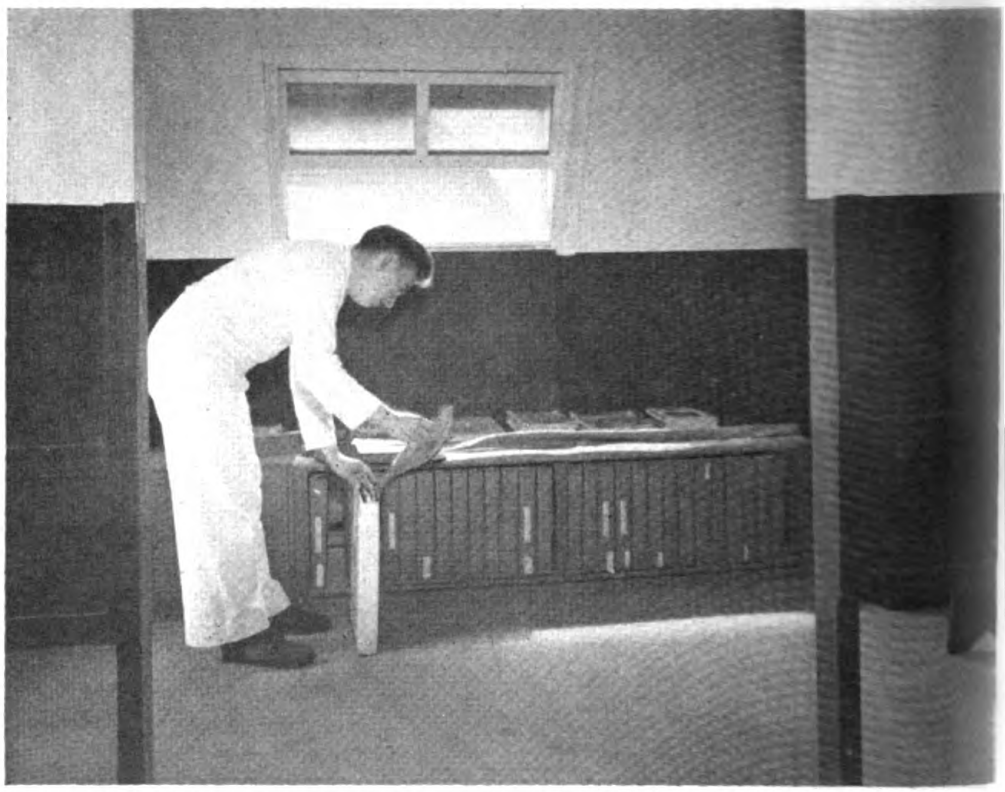
2. X-ray hut viewed from front. The 220-volt line comprising a pair of No. 2 conductors enters beneath the third window on the left; ground connection to pipes driven 15 feet into earth. Three No. 6 conductors enter at front to supply 110 volts.



3. Office and film reading room.

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keep the patients occupied while awaiting examination. The wide bench beneath the window serves as filing space for old x-rays. Those films which are not necessary in the current numerical file are removed from their jackets, stapled along one edge, together with the original filing slip, and placed in discarded 14 by 17 film boxes. Each box is marked with the appropriate initial and all are arranged in alphabetical order. A spare section of a regular steel filing cabinet is placed beneath one end of the seat. The remainder of the bench is fitted with a canvas curtain which drops down to conceal the row of film boxes. The carrying cases for a portable x-ray unit are stored in the waiting room.



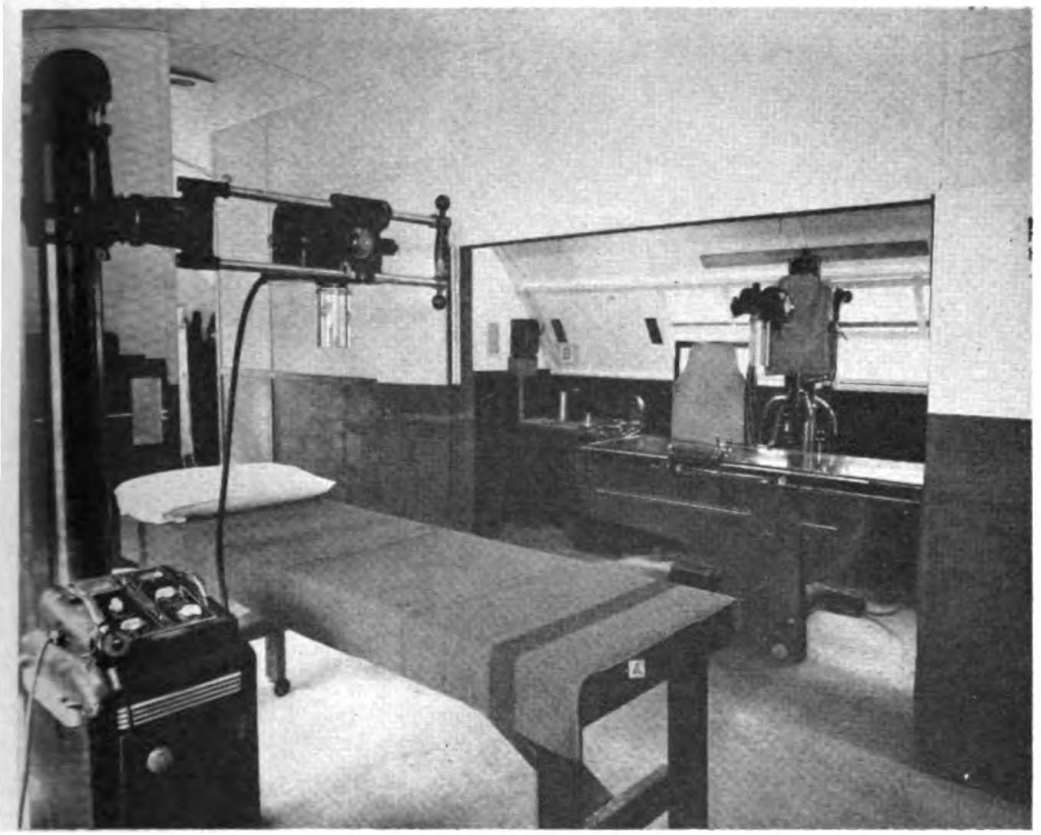
4. Waiting room showing accessory film filing space beneath bench.

COMBINED GENERAL X-RAY ROOMS

The central portion of the hut is given over to two general x-ray rooms (fig. 5). These communicate through a doorway 8 feet wide and 6½ feet high. The effect is that of a single large room, but the space on the right may be readily converted for fluoroscopy by closing two folding doors and securing the black-out shutters (B in fig. 5) which slide over the windows on that side. Access to the fluoroscopic room is then by way of a maze at the far end of the space, and adequate ventilation is provided by fans, one in the entrance to

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the passage and another, in a lightproof housing, set in the bulkhead between the fluoroscopic room and the office. The doors between the two rooms are normally folded back against the outside of the bulkhead and secured by heavy webbing straps. On the inner surface of the doors near the deck are metal brackets which receive a baseboard 8 feet long and about 4 inches wide (B in fig. 9). To this is attached a canvas "skirt" which effectively seals the space between the bottom of the door and the deck and does away with the need for a threshold across the 8-foot doorway.



5. Combined general radiographic room, mobile x-ray unit and table in foreground. The apparatus in the space to the right is a 100 ma. self-rectified unit with shockproof, double focus tube. The double doors are folded back and secured by straps.

The necessary dim light in the fluoroscopic room is provided by covering a single 50-watt lamp on the overhead with a housing of cardboard and heavy red paper. This lamp is independent of the general lighting circuit and is turned off and on by a simply constructed treadle switch which has been combined with the standard fluoroscopic foot switch. Inasmuch as the fluoroscopic and heavy-duty roentgenographic units are combined, all radiography requiring a high-milliampere technic must be held over while the fluoroscope is in use. Gen-

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eral x-ray of the extremities, however, and examination of the nasal sinuses and mastoids may be carried on concomitantly in the adjacent x-ray room using the 30-milliampere mobile unit. Fogging of film as the result of exposure to secondary radiation from one room to the other has not been observed.

A long wooden table mounted on heavy casters (A in fig. 5) is used in conjunction with the mobile x-ray unit. This provides an unusual degree of flexibility and greatly facilitates the handling of patients in bulky casts.



6. Mobile x-ray unit in position for radiography of the nasal sinuses with patient sitting upright.

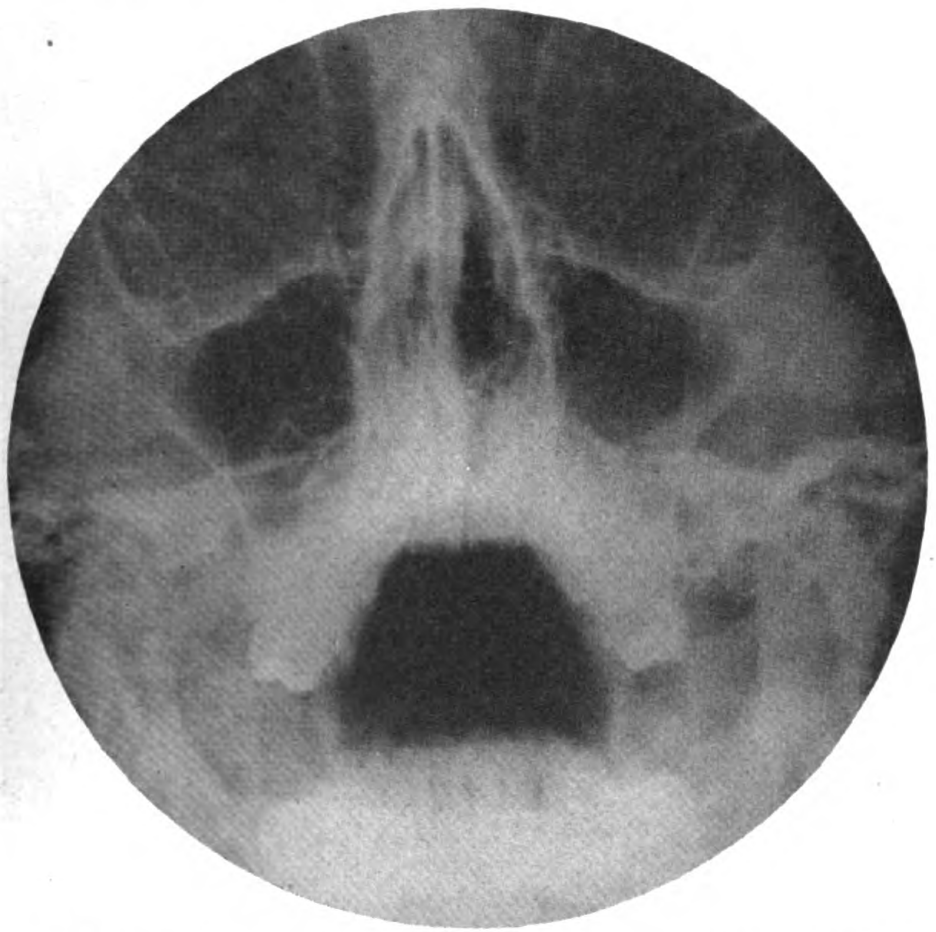
A plywood tunnel has been constructed which accommodates a 14 by 17 cassette with a stationary grid. This combination, which is used routinely for urologic examinations in a separate building, is readily adaptable for all examinations in which the use of the Potter-Bucky grid is impracticable, and for examination of heavy subjects on the mobile table when the Bucky table is otherwise employed.

For examination of the nasal sinuses with the patient in the upright position, a wooden framework supporting a shielded cassette tunnel has been constructed (A in fig. 6). This unit is hung on the side of the steel film-filing cabinet and is easily removable. Exposures are

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confined to an area about 5 inches in diameter in the center of an 8 by 10 film. After the desired exposure is made, the cassette is covered with a mask which supports a lead disk over the area of the film previously exposed. The number and side marker are applied to the mask, and a second exposure sufficient to blacken the film is made.

We have found that the sitting posture may be utilized to advantage for Law projections of the mastoid process, but this advantage is purely one of ease in positioning the patient. Typical x-rays obtained with this apparatus are reproduced in figures 7 and 8.



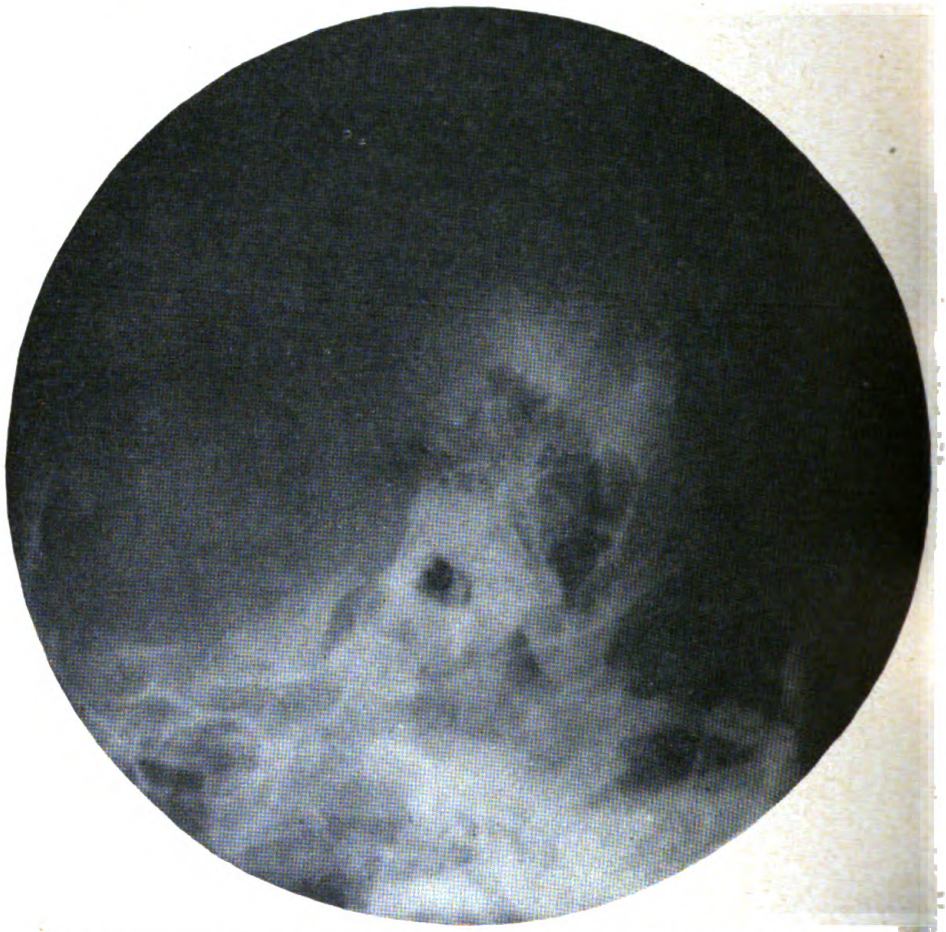
7. Reproduction of radiograph of maxillary antra (Waters position).

Chest x-ray which is done with the 100-milliampere unit, is simplified by having the adjustable cassette holder bolted to the bulkhead opposite the foot of the table exactly 6 feet from the end of the tube track (fig. 9). When the tube is centered to the table, pushed to the far end of the track, and rotated 90° about its transverse axis, it remains only to adjust it to the height of the patient to obtain the standard projection.

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GENERAL STORAGE AND REST ROOM

The space at the rear of the hut on the right side has been utilized primarily for storage (fig. 10). A large lead-lined safe contains at least a month's supply of x-ray film in tropical pack and serves also as a paint locker. A considerable supply of chemicals is stored on shelves along the outer bulkhead and in front of the shelves is a folding



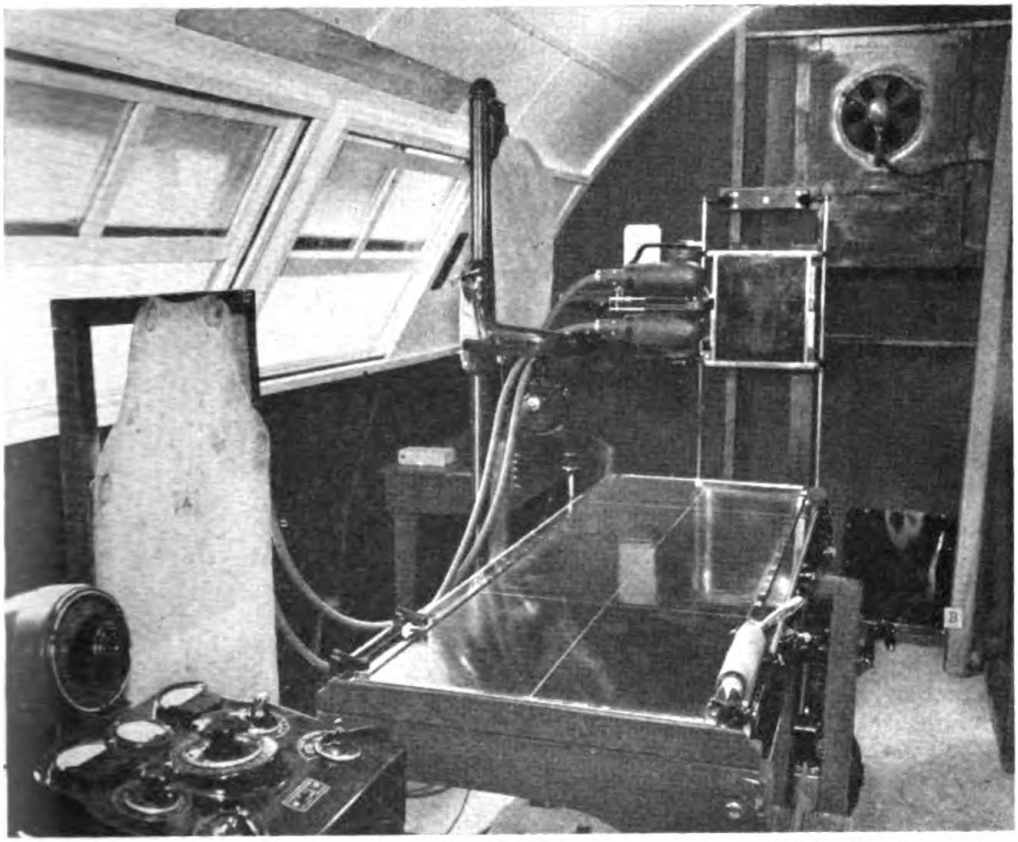
8. Reproduction of radiograph of mastoid process (Law position).

cot where patients may relax if necessary during a gastro-intestinal examination. The passage (maze) from the fluoroscopic room opens directly on this space. A portable bedside commode is kept behind a folding screen in this portion of the hut. As a rule, the commode is moved into the fluoroscopic room for a patient to evacuate the barium enema following examination of the colon.

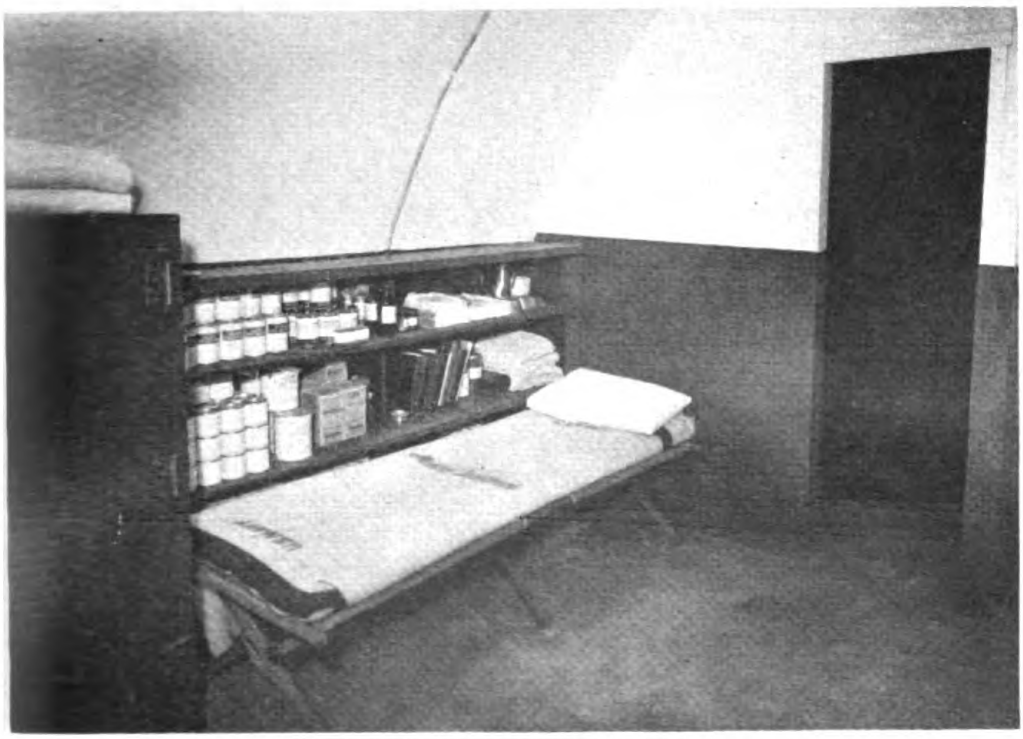
FILM PROCESSING ROOM

The darkroom was planned with an eye toward accessibility, adequate ventilation, and sufficient floor space (fig. 11). The need for

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9. Combination fluoroscopic and radiographic room; unit in position for radiography of thorax.



10. Storage and rest room.

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doors or curtains is obviated by providing a passage 2 feet wide and 12 feet long with a side entrance open to a height of 6½ feet. The interior of the passage as well as the end bulkhead of the darkroom proper is painted dull black. A white stripe down one side of the passage serves to guide persons not accustomed to entering this space.

A 4-foot section of the bulkhead which forms the outer wall of the passage at the far end of the hut is removable and is set aside to provide easy access during inspection, and for the transfer of material, as when fresh solutions are being prepared.



11. Film processing room from rear at end of passage.

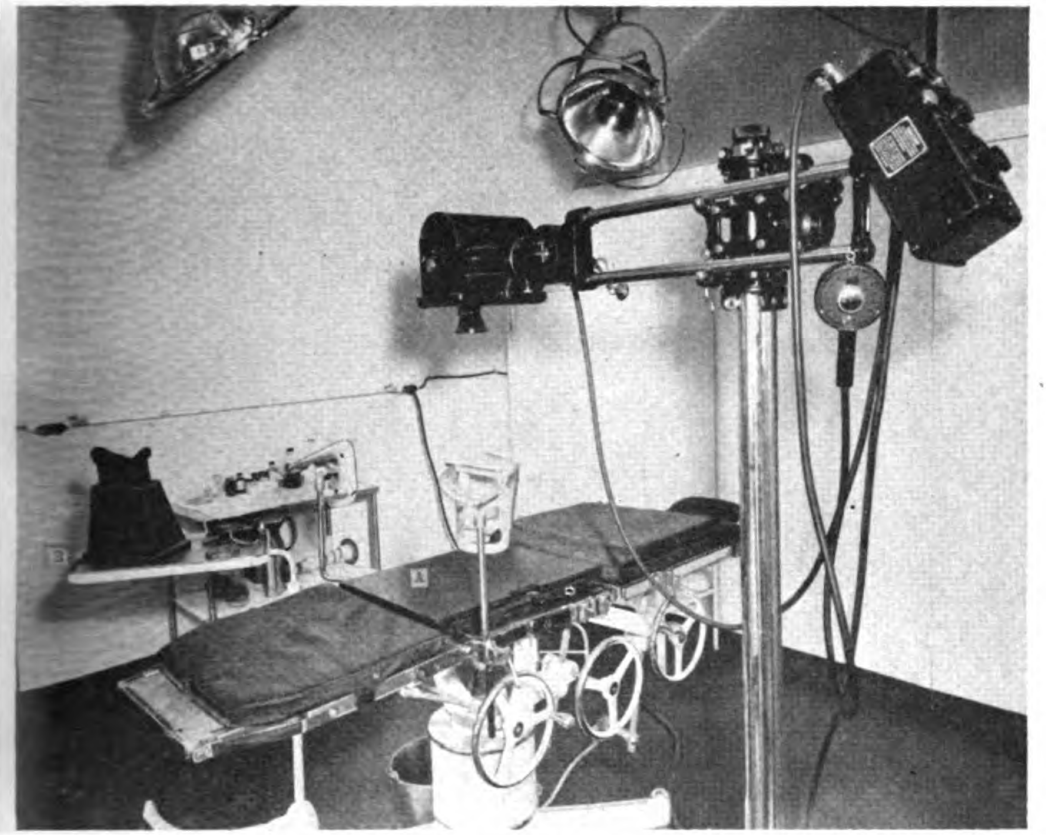
The film storage and dryer cabinet at the far end of the darkroom (fig. 11) is equipped with a powerful fan which draws air across a heating element and through a compartment in which the washed films are supported in a sliding rack. The intake end of the cabinet is seated against an opening in the lower section of the bulkhead where a system of louvers and a lightproof hood allow air to be drawn in from the adjacent x-ray room without admitting light. A constant change of air in the darkroom is assured by a lightproof fan installed in the bulkhead at the opposite end of the room.

Cassettes are opened and loaded on top of the dryer cabinet and the black paper film wrappers are discarded into a large wastebasket immediately to the right.

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The processing tanks are cooled by a built-in refrigerating unit and the maintenance of optimum developer temperature has been no problem despite the tropic heat. By keeping the flow of water through the wash tank at a minimum, no serious difficulty with softening of the gelatin has been encountered.

Washed films are transferred to the long dripping rack over the drain boards on either side of the sink before their transfer to the dryer.



12. Standard operating table adapted for urography by addition of grid and cassette tunnel. Small fluoroscopic screen and lead diaphragm on instrument table to left.

Two safe-lights, each with a 50-watt lamp behind a Wratten filter, supply general illumination. A viewing box has been constructed which rests on the drain board immediately to the right of the processing tank.

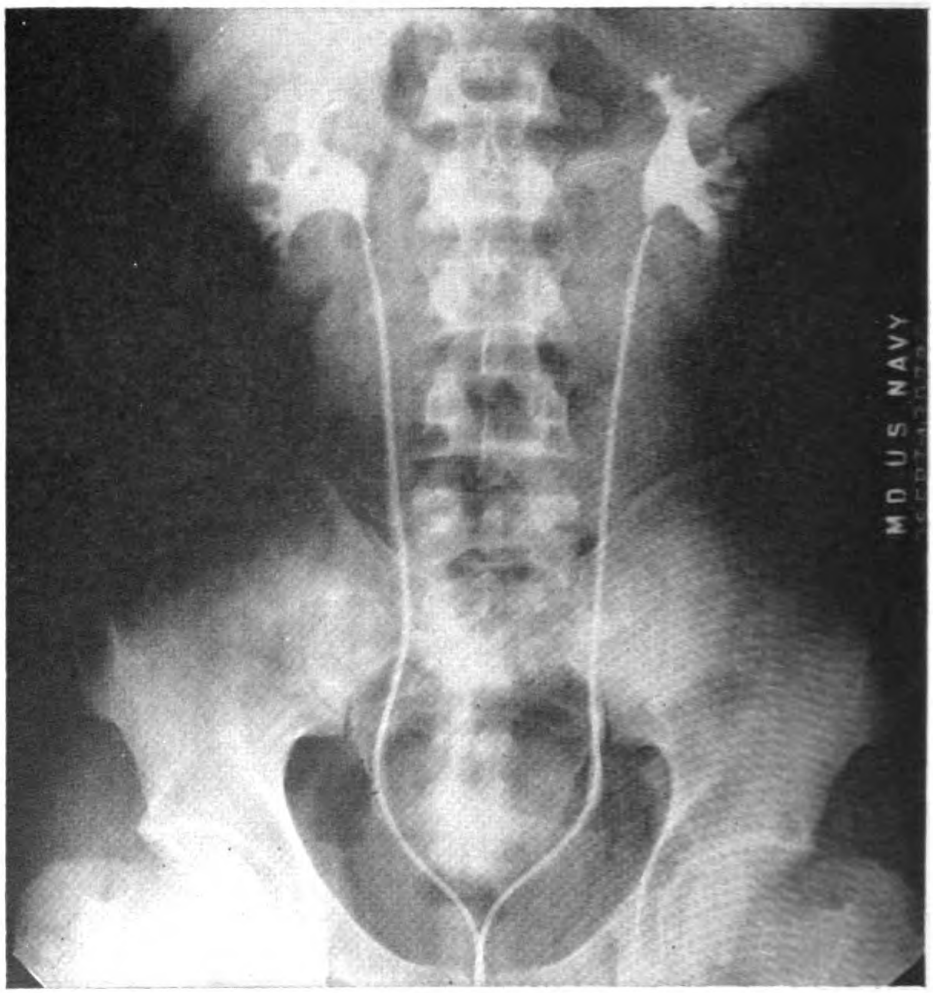
MISCELLANEOUS

Having had one unfortunate experience (warping) with the effect of high humidity on the radiographic grid, we feel justified in advocating that it be kept not only in its original hardwood shipping case, but also that the box be modified by the insertion of a smooth plywood panel so that the grid may be kept under constant pressure when not in use. Adequate pressure is conveniently supplied by

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sandbags piled up on top of the case (B in fig. 6). The same sandbags are used for immobilization in x-ray.

The problem of protection of personnel from harmful secondary radiation has been met by constructing wooden racks which support the standard lead rubber aprons (C in fig. 6 and A in fig. 9). Each rack is fitted with a set of four casters so that it may be pushed into position between the operator and the patient before an exposure is made.



13. Reproduction of radiograph (retrograde pyelogram) made with portable x-ray unit and stationary grid; 37½ ma., 30-inch distance.

Figure 12 shows the adaptation of the 14 by 17 cassette and grid tunnel (A) for urography when using the portable x-ray apparatus. The center section of the rubber pad which covers the operating table is folded back to accommodate the tunnel. With the patient in position on the table, the double pad beneath his shoulders and upper chest is compressed to approximately the thickness of the tunnel. A rubber sheet may be spread over the tunnel to protect its contents from wetting during a cystoscopic examination. A reproduction of

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a typical urogram obtained with the above apparatus is shown in figure 13.

Also shown in figure 12 is the modified hand fluoroscopic screen and hood (B) which is required occasionally by the orthopedic surgeons. A lead diaphragm or cap is placed over the end of the small cone on the portable x-ray tube head to columnate the beam of radiation so that it covers only the area of the screen when the screen is held 15 inches from the end of the cone. Excessive exposure of the examiner to the direct beam is thus avoided.

It is our good fortune to have available two portable x-ray units of the type shown in figure 12. This permits us to keep one unit in the urographic room or in the adjoining orthopedic room while the second unit is free to be moved about to the various hospital wards.

The importance of a concrete deck in the x-ray hut can hardly be overemphasized. With our equipment in operation on a wooden deck we found it necessary to require that all personnel stand still while an exposure was being made. Swaying of both the table and x-ray unit was otherwise excessive.

Reasonable proximity to a 75-kw., 220-volt generator and a connection to the power line *ahead* of any other connections which draw a significant amount of current, has permitted satisfactory operation of all equipment with unusual stability in voltage. In a less favorable location with respect to the power supply, we were obliged to install a separate 10-kw. generator for our exclusive use.

ADAPTATION OF THE WESTERGREN METHOD OF SEDIMENTATION TEST

JULIAN LOVE
Captain (MC) U. S. N.
ROBERT N. GANZ
Lieutenant Commander (MC) U. S. N. R.
and
HENRY D. FEARON
Lieutenant Commander (MC) U. S. N. R.

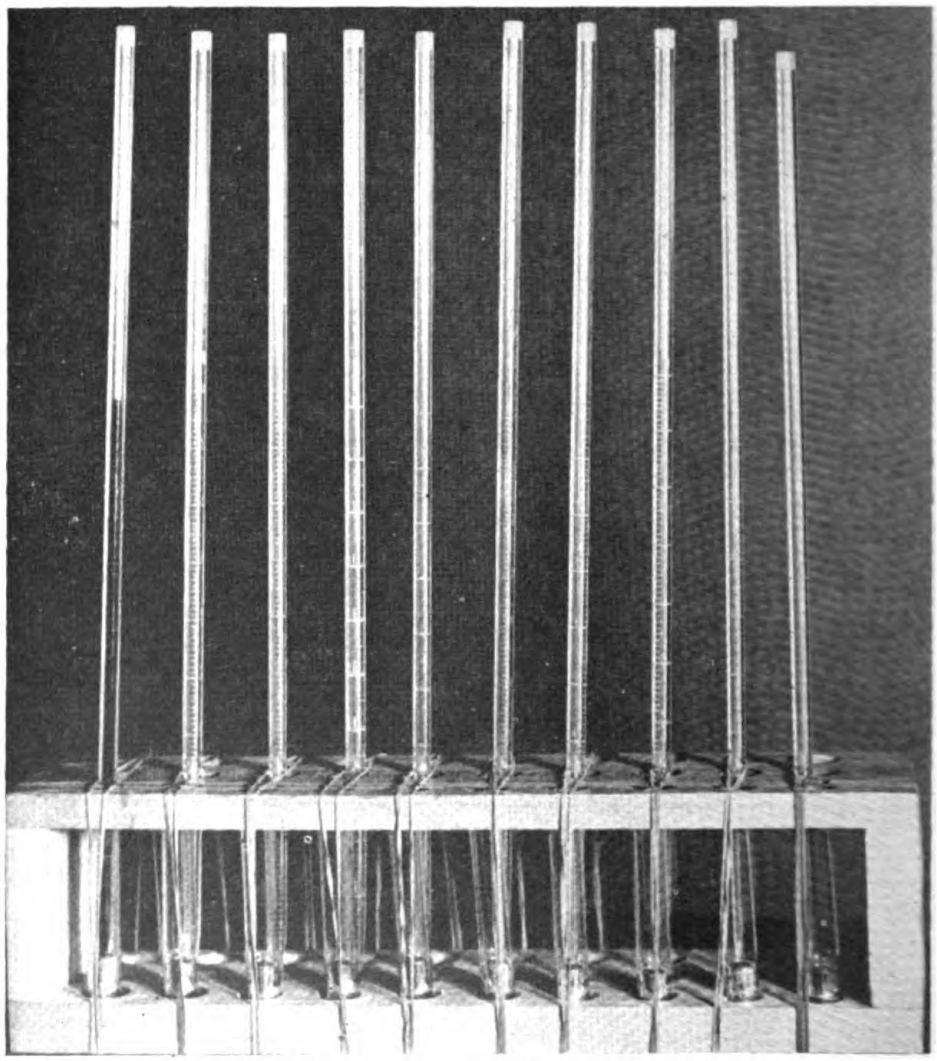
The sedimentation test is widely used in most naval hospitals and dispensaries. The rate of erythrocyte sedimentation is increased above the so-called normal in most acute general infections and in severe localized acute inflammatory conditions, but the particular value of the test is in the generally increased rate present in most subacute systemic infections. It is used routinely as a measure of improvement, or lack of improvement, in such conditions as acute or chronic rheumatic fever and rheumatic arthritis.

Under the varying conditions prevalent in time of war, facility in laboratory examination is essential. The three generally accepted

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procedures for determining sedimentation rates are known as the Cutler, Westergren, and Wintrobe methods. Of these the Westergren tube, due to its length, is subject to less of the error imposed by early cell packing. While this latter method gives relatively satisfactory readings with less manipulative difficulty, it has not been generally available through the Navy Supply Table, since it has usually required the stocking of a less easily obtained special tube and standard.



1. Showing 1-cc. pipettes immersed in mercury in Kahn tubes.

In an outlying base, following the breakage of several Wintrobe tubes which were at hand, and being unwilling to re-evaluate by the Cutler method our studies of progress in certain chronic infections which were under treatment, we found it possible to construct satisfactory Westergren tubes from supplies at hand or readily available.

A test-tube rack was constructed of wood, similar in type to the available Kahn rack, but with sufficient clearance between the upper and lower shelves so that the tops of the tubes were not quite flush with the

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upper surface. The available 1-cc. serologic pipettes (graduated to 0.01) were found, with minimal variation, to measure the required 200 mm. from the tip to the "0" reading. The diameter of the bore of these tubes is approximately 3 mm. as required. Approximately 1.2 cc. of metallic mercury, placed in individual Kahn tubes, gives sufficient pressure to prevent the outflow of citrated blood in such pipettes, the tips of which are immersed in the Kahn tubes partially filled with mercury as indicated.

A series of elastic bands over the rack can be arranged to stabilize the pipettes and maintain them in absolutely upright position. Care should be taken to avoid unnecessary disturbance of the set-up after the pipettes have been placed in the mercury, as a break in surface tension of the mercury may allow seepage of the blood column.

This arrangement provides space for an indefinite number of these substitute Westergren tubes, is easily available, and permanent in character. It avoids the necessity of subsequent manipulation, or steps involved in such suggested modifications as sealing the pipettes with additional rubber bands, paraffin, and the like. The apparatus is shown in figure 1.

In a series of tests run on 20 normal male adults in this laboratory, the variation by the Westergren method was found to be between 2 mm. and 22 mm. per hour. One of us, in previous studies on 200 children up to the age of 15 years, found the normal variation to be 2 mm. to 30 mm. per hour.

POSTOPERATIVE ANESTHESIA IN DENTAL SURGERY

SAMUEL E. MISNER
Lieutenant Commander (DC) U. S. N. R.

The use of local anesthesia for cavity preparation and dental surgery is a commonly accepted form of procedure. However, the patient often returns complaining of extreme pain after the anesthesia has worn off. It is felt that it would be advantageous to prepare the patient after extractions and surgery so that he will not suffer before his next scheduled appointment, and at the same time keep swelling down to a minimum.

The following is a formula of an ointment or surgical dressing which has been used for the past 2 years, as a routine procedure following extractions and surgery. It is particularly useful in immediate dentures. It is used on and in the denture and carried to any desired area in the mouth.

	Gram
Sulfathiazole	5.00
Procaine hydrochloride	.60
Eugenol	.15
Base q. s.	30.00

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A jar is half filled with the ointment, into which is worked a yard of sterile half-inch plain gauze, to be ready when needed.

Following extractions, a wick of this gauze with a liberal amount of ointment is inserted lightly into the bottom of the socket and then partly withdrawn. This leaves an area for blood clotting, and also a center wick containing sulfathiazole which combats infection. The procaine hydrochloride is gradually absorbed by the surrounding tissues, supplementing the injected local anesthesia.

The gauze acts as a drain and also prevents the ointment from being washed away. This is not a "packing," and is left preferably 48 hours before removing. A second smaller wick is inserted at the second visit. It is removed in 24 hours. Following severe extractions, 1 or 2 drains may be required.

If sutures have been used, a tip of the drain is left exposed for ease in removal. In this way granulation starts readily and the socket and wounds heal quickly from the bottom, without complications. It is seldom necessary that the patient lose any time from duty.

When adjustments or relief are necessary on dentures, this ointment is placed on the relieved area of the denture, and is thus carried to the place of irritation in the mouth. This will give comfort to the patient in a very short time.

A so-called "dry socket" has not been observed when this procedure has been followed.

AN INSTRUMENT FOR ADULT CIRCUMCISION

CHARLES H. FIELD
Lieutenant (MC) U. S. N. R.

The purpose of this paper and accompanying illustrations is to present an instrument to facilitate circumcision in adults. It is realized that the idea for such an instrument is not original, but it is believed that this is the only one of its exact type used on adults.

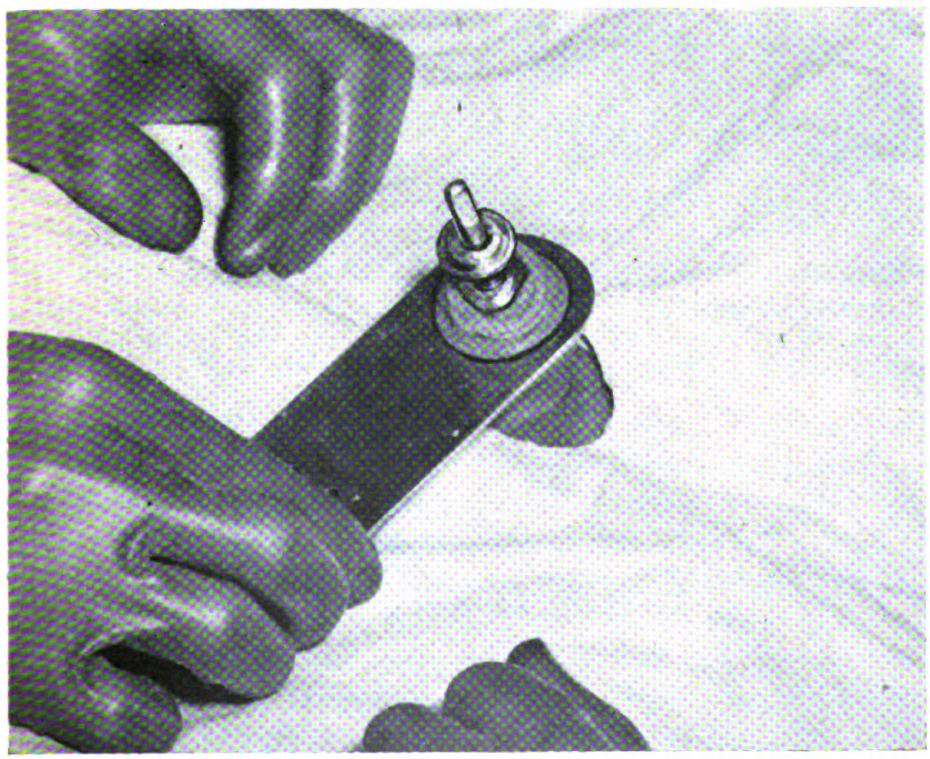
The photographs are self-explanatory, but an additional word about its construction is deemed advisable. The instrument is made of stainless steel, can be disassembled to facilitate sterilization, can be used by other than experienced operators and is not cumbersome. The immediate and later advantages of the instrument will be discussed.

The disassembled instrument consists of four parts, the cup, the "bed" plate, the strong back, and the tension screw. The cup is shaped, as the name implies, with the inside measurement of $1\frac{7}{32}$ inches at the base, $\frac{5}{8}$ inch at the apex, and $\frac{13}{16}$ inch in depth. The outer surface of the cup is 1 inch tall, $1\frac{1}{4}$ inches at the base and $\frac{5}{8}$ inch at the

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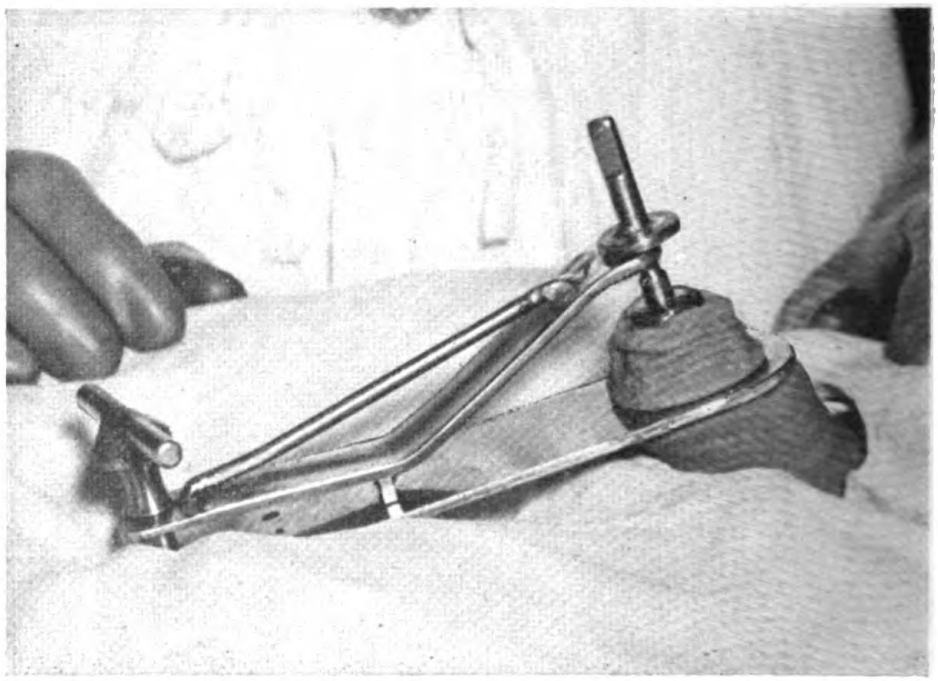
1. Cup in position for application.



2. Cup in position and "bed" plate applied, so that the beveled cup seat fits outer cup surface.

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apex slanted at an angle of 22° (or 44° combined angle) from base to the apex, with an inner surface slant angle of 20° to allow for appropriate thickness of the cup. Extending from the apex of the cup upward is a stem ¼ inch in diameter and 1½ inches long, the upper inch of which lies above the strong back stop and is for purposes of maneuvering the cup. The strong back stop is located on the stem ½ inch above the apex of the cup and is ½ inch in diameter to rest on the upraised arm of the strong back. The stem above the apex and below the strong back stop is slimmed in its upper half from the original ¼-inch diameter of the stem to 3/16 inch to facilitate application of the forked end of the strong back to the stem. The over-all length of the cup and stem is 2½ inches.

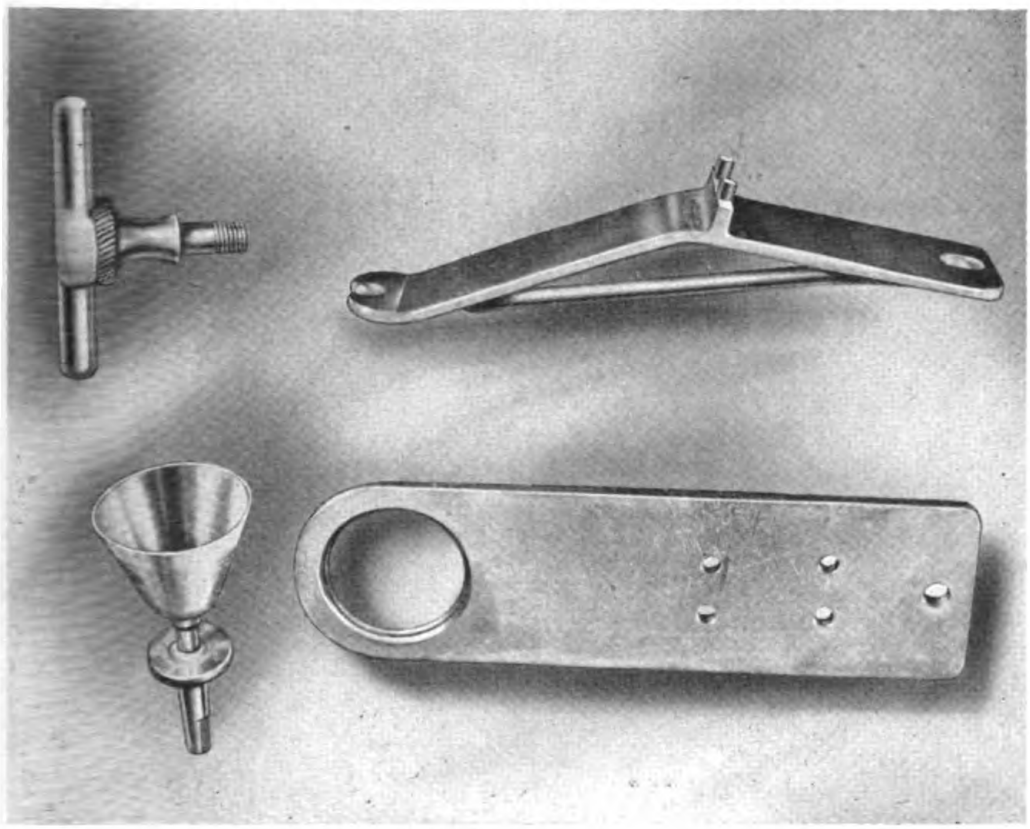


3. Instrument complete and prepuce compressed tightly by pressure applied on tension screw. The redundant prepuce is now removed by encircling incision with scalpel.

The "bed" plate is 6 inches long, 1 13/16 inches wide and 3/16 inch thick, having the cup seat ¼ inch from the cup end of the "bed" plate. There are 2 holes 1¾ inches from the tension screw centered ¼ inch from the center line of base into which fit the 2 lower projections of the fulcrum attached to the lower strong back surface, and a threaded hole for the tension screw ¼ inch from the leverage end of the "bed" plate. The cup seat is 1¼ inches in diameter, beveled at an angle of 22° and has a sharp V groove in the middle of the beveled surface. The holes for the lower fulcrum projections are 2 in number and ⅛ inch in diameter. The threaded hole for the tension screw is of the size to accommodate a screw ¼–28 size.

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The strong back is shaped so that its leverage end and the portion which rests below the strong back stop is parallel to the "bed" plate and the intervening portion angularized to join these two parts. It is 1/8 inch by 7/8 inch by 5 1/4 inches and has a forked cup end which slips onto the slimmed upper arm of the cup just below the strong back stop. The fulcrum is attached to its undersurface just beyond the angle made by the slanted arm and the parallel leverage arm of



4. View showing four parts of the instrument. In upper left-hand corner, the tension screw. Upper right, the strong back in inverted position to reveal the lower fulcrum projections. Lower left, the cup. Lower right, the lower surface of the "bed" plate to reveal the beveled cup seat and V groove in the middle of this.

the strong back as seen in the photograph. Pivot pegs of the fulcrum are 3/32 inch in diameter. There is a hole 1/4 inch from the leverage end of the strong back through which the tension screw passes. There is a strut on the upper surface of the strong back to lend additional support and prevent flexion of the strong back.

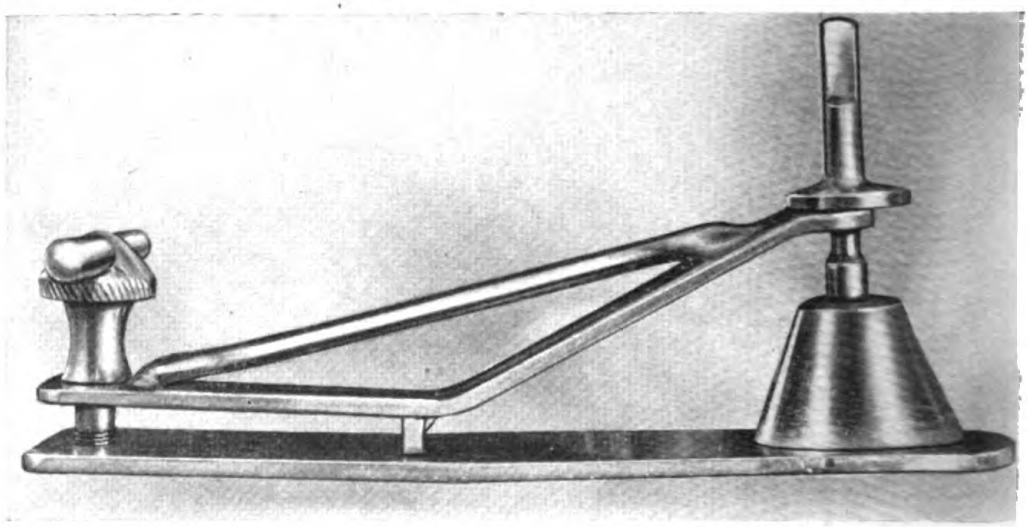
The tension screw, 1/4-28, has a wing nut head to facilitate application of pressure and is graded so that the stop on the screw exerts pressure downward on the upper surface of the strong back.

It must be noted that the illustrations reveal the "bed" plate to have 2 inactive holes between the screw and fulcrum pivot holes which were misplaced in earlier experiments of manufacture.

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There may be some doubt that any one cup can be devised to fit the many sizes of glans encountered, but this has presented absolutely no problem, in that no glans penis has been encountered so far which was too large to enter the cup. Smallness of size of the glans penis presents no problem, for the cup is of sufficient length to insure an incision line proximal to the frenulum of the prepuce and also the corona sulcus, and it is assumed that even if an extremely large glans were encountered enough of it would enter the cup. The construction of the instrument is such as to prevent any injury to the frenulum of the penis.

The patient is prepared as for any circumcision. Anesthesia is obtained by injection of 2-percent novocain about the base of the penis to block the dorsal nerve.



5. Lateral view of assembled instrument.

The redundant prepuce is retracted, the cup is slipped over the glans, sterile vaseline is applied to the undersurface of the cup, and the prepuce is slipped forward onto the cup. The "bed" plate is applied as shown in the photographs, causing the prepuce to be fixed between the beveled surface of the cup seat and the outer surface of the cup. The strong back is then applied, slipping the forked end onto the cup stem below the strong back stop, and the fulcrum projections are inserted into their holes on the "bed" plate. Holding the instrument in this position the tension screw is then applied and by screwing this into position the cup is elevated in such a manner that the prepuce is compressed between the outer cup surface and the beveled cup seat.

The instrument thus applied is left intact for 2 or 3 minutes, and the prepuce is removed by an incision, flush with the upper "bed" plate surface. The resulting ring of prepuce about the cup stem is cut and removed. Pressure on the cup stem is released by loosening the tension screw and the instrument is disassembled and removed.

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Large bleeders are clamped and tied using No. 40 cotton sutures, the smaller vessels being occluded by the pressure formerly exerted. The opposing skin margins are then approximated with absorbable catgut sutures.

This instrument has the following advantages: (1) Shortened time of operation; (2) more complete hemostasis; (3) smoother incision line; (4) less use of suture material; (5) a neater field of operation; and (6) more rapid and efficient postoperative healing because of the more complete hemostasis, with better approximation of opposing skin margins due to the smoother incision lines, and less trauma due to less handling of tissue.

The time for the operation has been reduced to one-third the time for the dorsal slit or related methods for circumcisions. The more complete hemostasis is vividly demonstrated by use of this instrument. That a smoother line of incision is obtained is apparent due to the limitation of irregular incision by the smooth surface of the "bed" plate. Less suture material is used because many of the smaller vessels were sufficiently compressed by the pressure to obviate the necessity of tying them.

It is noted that cotton is used for vessel ligation at this time and has in its favor the many advantages listed by other operators. The field of operation is neater, for very little bleeding is encountered until the clamp is removed. The only bleeding which occurs is due to the blood that might be in the larger vessels located in the prepuce distal to the site of pressure by the cup and cup seat. That more rapid and efficient postoperative healing will occur is only surmised as the instrument has not been used for a sufficient time for this to be determined adequately.

Phimosis presents no problem to the application of this instrument and proceeding in the prescribed manner for following a simple dorsal slit, the prepuce can be retracted, the cup applied and the instrument used as previously described.



POSTOPERATIVE FOOT EXERCISES

Much thought has been devoted in recent years to the treatment of thrombophlebitis, phlebothrombosis, and the frequently associated pulmonary complications and subsequent leg edemas. Less attention has been paid to the prevention of these serious and distressing conditions. The usual preventive measure for circulatory stasis in the legs has been the use of bicycle or some other form of exercises.

The advantages of the foot exercises are as follows:

1. They are easy and simple to perform.
2. They are painless.

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3. They effectively and frequently stimulate the venous circulation of the calf where most of the dangerous and silent thrombi originate, etc.

Written instructions in the performance and necessity of the exercises, given to patients to read preoperatively, also enhance the possibility of successful prophylaxis against thrombosis.

This is accomplished by giving the patient the following letter the day before operation (except in cases of thyroid and nose and throat surgery):

After your operation the surgeon would like to have you do foot exercises. Just as soon as you are able, you are to start moving the ball of each foot up and down slowly, as if, for instance, you were trying to reach down with your toes and touch the end of the bed. One or both feet can be exercised at the same time. It is not necessary to move the legs except to stiffen them out occasionally. These exercises should be done nearly 1,000 times in 24 hours.

In certain cases the nurse will awaken the patient several times during the night and request that foot exercises be done for a few minutes. Any time that you happen to awaken during the night the exercises should be done for a few minutes. These simple exercises contract the muscles of the lower leg and this helps to speed up the circulation which has been slowed down because you are confined to bed. If you notice any discomfort, no matter how slight, in the legs and particularly in the calves, that you did not notice before, please report it to the nurse.

Gentle arm exercises aid the circulation also. These instructions should be carried out every day that you are confined to bed in order to insure a rapid and uneventful recovery.—BOEHME, E. J., and ADAMS, R.: Prophylaxis against thrombosis. Lahey Clin. Bull. 3: 142–145, July 1943.

ULCERATIVE ENTEROCOLITIS

One cannot emphasize too strongly the importance of establishing as nearly as possible the nature and cause of the many varieties of ulcerative enterocolitis. Each type recognized to date has some characteristic features which set it apart from the others. In the streptococcal variety, the diffuseness of involvement and the typical proctoscopic and roentgenologic pictures together with the finding of the streptococcus are important. In the amebic, the finding of Endamoeba histolytica is of the greatest importance. In tuberculous colitis, the presence of Mycobacterium tuberculosis, together with the history and finding of tuberculosis elsewhere, is of great value. In the cases due to Shigella paradysenteriae significant agglutinin titer of the blood serum is significant. In the cases due to the virus of venereal lymphogranuloma, the positive Frei reaction and the characteristic appearance of the lesions are essential. In the regional types and the groups still of unknown cause, continued and careful study is essential. It is important that these be not confused with those forms of ulcerative colitis of specific cause and characteristic features.—BARGEN, J. A.: Present status of ulcerative colitis and regional enteritis. Bull. New York Acad. Med. 20: 34–45, January 1944.

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EDITORIALS

WOUND INFECTION AND LOCAL SULFONAMIDE

Reports from the field lead one to believe that wound infection in general is not a major problem. Proportionately few casualties die of septicemia. Tetanus and gas gangrene are relatively infrequent occurrences.

Speculation as to the cause of this favorable situation appears to center around topographic conditions, the value of immune vaccines, sulfonamides, and the prompt administration of first aid.

The intensive investigation on wound infection has not lessened the controversy relative to the value of topical sulfonamide therapy. The observation that injured tissue, exudate products, pus, detritus, and the like, neutralize the specific local action of the drugs, rendering application valueless and in some instances even promoting harmful complication, is reiterated.[1, 2] As a result, dispensing the drug in first-aid kits as a dusting powder has been discontinued by some authorities.

Nevertheless the practical reports of men in the field invariably attribute the low score of wound infection to sulfonamides. The consensus is too general to admit a casual dismissal.[3, 4, 5, 6] Clear discernment, however, must be exercised in order to arrive at an unbiased judgment in this matter. One must be positive that all factors have been considered. The confirming evidence must be more than circumstantial as nothing can be more misguiding than the interpretation of the therapeutic value of a drug.

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[1] MELENEY, F. L.: Study of prevention of infection in contaminated accidental wounds, compound fractures and burns. Ann. Surg. 118: 171–186, August 1943.

[2] GALLAGHER, J. L.: Definitive treatment of severe wounds; large surface to small area. J. A. M. A. 123: 675–680. November 13, 1943.

[3] SCHMOELE, J. M.; HUSTON, H. R.; OWEN, E. P.; SIMON, J. I.; COBURN, D. F.; GILLESPIE, C. E.; and RIDGEWAY, E., Jr.: Surgical management of war wounds at U. S. Naval Base Hospital ——. U. S. Nav. M. Bull. 41: 1525–1539, November 1943.

[4] KERN, R. A.; NORRIS, R. F.; MONTGOMERY, H.; WIGTON, R. S.; FERGUSON, L. K.; and BROWN, R. B.: Treatment of burns; discussion based on experience with 360 cases seen on board U. S. Hospital Ship. U. S. Nav. M. Bull. 42: 59–81, January 1944.

[5] NICHOLSON, J. T.; FERGUSON, L. K.; BROWN, R. B.; and GODFREY, E. W.: Treatment of compound fractures aboard hospital ship. U. S. Nav. M. Bull. 42: 607–622, March 1944.

[6] YANDELL, H. R.: Experience in treatment of burns; from South Pacific area. U. S. Nav. M. Bull. 42: 829–837, April 1944.

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It is contended that the compiled experimental data are not comparable owing to a time element. The immediate application within a safe period before contamination has had a chance to turn into invasion is observed in the battle zone. The investigation program however begins its observation only at the time of hospital disposition of the patient—a considerable period when contamination may have become multiple or advanced imperceptibly to invasion. Nevertheless it is admitted that sulfonamide blood concentration is responsible for the low incidence of generalized septicemia and the small mortality: that sulfonamides minimize invasion and tend to keep the infection confined to the immediate vicinity of the original contamination. All of which however is effectively accomplished by oral or parenteral administration.

Increasing evidence on the other hand points out that the least first-aid topical manipulation done to a wound materially results in lowering the incidence of infection and complication.

De Waal[7] among others has shown that in wounds cleaned and dressed, infections were more frequent than in those which had been only dressed.

Wounds which had been covered at an early stage with a sterile dressing arrived at the hospital in the least infected state.

It was moreover shown that when first-aid cleaning of wounds was done, more than twice as many infections by hemolytic streptococci occurred than when the wound was simply dressed without attempt to clean it.

Eighty-six percent of all wounds and 67 percent of burns became infected during hospital treatment.

Yudin[8] discussing gunshot fractures on the Russian front is emphatic on the use of local sulfonamides, stating that after excision the wound is "liberally filled with a sulfonamide powder carefully insuring that no part is missed." This procedure is considered one of the "indisputable principles" responsible for the success of their battle surgeons. It must be admitted, however, that oral sulfonamides are equally stressed and hence for this reason compromise the evidence of the value of local application.

It is apparent that the evidence for or against continued topical use of sulfonamides is not conclusive. Nevertheless the controversy should not end here. Aside from the clinical aspect, the economics involved makes the problem most urgent. The saving of tons of the valuable drugs warrants a redoubling of energies toward a final solu-

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[7] DE WAAL, H. L.: Wound infection; preliminary note on combined clinical and bacteriological investigation of 708 wounds. Edinburgh M. J. 50: 577–588, October 1943.

[8] YUDIN, S. S.: Treatment of gunshot fractures of limbs. Brit. M. J. 2: 567–572, November 6, 1943.

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tion. Renewed experimentation, assaying among other properties the time factor and application under battle conditions, may go far in re-evaluating topical sulfonamides.

WOUND HEALING

Some recent interesting work on dogs reveals the agglutination phenomenon of tissue. Within 6 hours after a gastro-enterostomy the site of surgical anastomosis had so securely united that it was difficult to separate the approximating margins shorn of their suture material.

Similarly Sano's report on the coagulum-contact method [1] of skin-grafting emphasizes the speed of tissue agglutination. A cell extract or tissue glue is prepared from the patient's blood and painted over the graft, the recipient area being covered with plasma. By careful manipulation and slight pressure the graft is fitted in place. Within 48 hours the take is so fast that it is difficult to determine microscopically the exact site of union between the graft and the underlying tissue. The union is more than marginal, however; vascularization with established capillary circulation begins equally as rapidly throughout the body of the graft, early blending the take into the normal tint of the surrounding skin.

In every skin graft, hemorrhage has a definite effect upon the final take. The Sano method apparently has a decided hemostatic property—only actively bleeding arteries requiring ligature. It has been shown moreover that the bleeding surface of a wound of the liver promptly ceased after application of the solutions. Lozner et al.[2] and Bering [3] have developed a similar product referred to as fibrin foam which has proved equally excellent in hemostatic properties. The control of open capillary oozing and free venous bleeding have been reported with this product.

In 1911, Cushing [4] demonstrated the hemostatic properties of fresh muscle tissue in his neurosurgical work of that day. Sano claims that this property is enhanced by coating the graft with the coagulum-contact tissue glue, and that a more intense adhesion of muscle over the hemorrhagic area is obtained.

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[1] SANO, M. E.; HOLLAND, C. A.; and BABCOCK, W. W.: Use of coagulum-contact method in surgery. S. Clin. North America 23: 1673–1695, December 1943.

[2] LOZNER, E. L.; CRONKITE, E. P.; and DEAVER, J. M.: Preliminary report on use of thrombin and fibrinogen in skin grafting. In press.

[3] BERING, E. A., JR.: Development of fibrin foam as a hemostatic agent and for use in conjunction with human thrombin. In press.

[4] CUSHING, H.: Control of bleeding in operations for brain tumors; with description of silver "clips" for occlusion of vessels inaccessible to ligature. Ann. Surg. 54: 1–19, July 1911.

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However important these findings may be in the progress of plastic surgery, the insight into the physiologic dynamics of tissue repair is more revealing. The operating forces are apparently fundamental in tissue healing and provoke reflection on the introduction of suture material in wounds.

Perhaps delayed wound healing *is* man-made.



HYPERVENTILATION SYNDROME

Any normal person readily can experience the symptoms of hyperventilation by voluntary forced breathing. It is only necessary to force maximal inspiration and maximal expiration at an approximately normal rate. Within 30 to 60 seconds an odd sense of faintness and dizziness is noted. True rotary vertigo is not present, but an unsteadiness described as a "lightheaded" feeling is experienced. Within a minute or two a characteristic numbness and tingling type of paresthesia will be noted in the extremities and a sense of panic and palpitation are evident. The mind becomes clouded; surroundings take on an appearance of unreality and the person borders on unconsciousness. If the forced breathing is continued for five minutes or more, the muscles may become perceptibly tense and eventually the tetanic contractions of carpopedal spasm will ensue. In later stages a sense of air hunger may be experienced even during hyperventilation tending to produce a vicious circle. If forced breathing is continued, state of vasomotor collapse resembling shock may be produced. The pulse is weak, rapid and irregular and the skin is pale, cold and moist. The patient is in a state of extreme anxiety and often lapses into semiconsciousness.

These more violent manifestations are rare in clinical practice and occur only among frankly hysterical patients, but the milder sensations are common. Patients describe a feeling of constriction in the thorax, a sense of inadequate ventilation associated with dizziness, faintness and anxiety; when prolonged, the highly characteristic tingling and numbness of the extremities are present. Usually the patient does not know that he is hyperventilating, but in the more severe instances even an untrained witness may observe and report it.

The diagnosis is established by instructing the patient to hyperventilate in unison with the examiner for a minute or more, timed with a watch. Identical sensations are experienced by both doctor and patient, and the patient recognizes the sensations as those of his attack.

A few minutes of controlled respiration yields complete relief.—HINSHAW, H. C.: The syndrome of hyperventilation; its importance in aviation. Proc. Staff Meet., Mayo Clin. **16: 211–213, April 2, 1941.**

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BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

A TEXTBOOK OF MEDICINE, by American Authors, edited by *Russell L. Cecil, A. B., M. D., Sc. D., Professor of Clinical Medicine, Cornell University Medical College;* associate editor for diseases of the nervous system, *Foster Kennedy, M. D., F. R. S. E., Professor of Clinical Neurology, Cornell University Medical College.* Sixth edition, revised and entirely reset. 1,566 pages; 195 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1943. Price $9.50.

What is a textbook of medicine? Where is the borderline between an encyclopedic reference volume, and a guide for students? Cecil seems to this reviewer to belong to the encyclopedic category, and as such highly suited for Navy use. At one's elbow is a compend of special articles on all aspects of medicine, most of them monographs by men of national reputation.

Let's glance down the list. Sawyer on yellow fever, Wolbach on typhus, Cecil on the pneumonias, Helmholtz on scarlet fever, Finland on Friedländers infections, Rackemann on asthma, Alvarez on food poisoning, Spies on pellagra, Hench on gout; to which could be added scores more.

This brings us back to our beginning. Is this the consecutive, balanced volume to hand to the sophomore or junior, or is for him the one-man job, such as Christian's Osler, a better and sounder guide? My opinion is that Osler is decidedly the better textbook of the two for that purpose. There is an even, developing flow, no overlapping, no repetition, no omission. There is no clashing of literary styles to disturb thought.

But as a reference book for the graduate, this encyclopedia edited by Cecil would seem to have the call. What is the 1944 thought of

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Allen Whipple on the pancreas? What has Krumbhaar to say on current concepts regarding hemolytic jaundice? Has George Minot in these last months any new ideas on pernicious anemia?

It will be a comfort to know that the universal distribution throughout the service of this volume, carried as it is on the Supply Catalog, will give the lone medical officer on a destroyer or ashore in the jungle, a complete and authoritative reference library on internal medicine.

Despite woeful tales of paper restrictions, this edition is a better printer's job than its predecessors. The clear, coated paper, the slightly broader type page, two-columned, the excellent firm binding despite the 1,600 pages, all contribute to a charming presentation.

CLINICAL LABORATORY METHODS AND DIAGNOSIS. A Textbook on Laboratory Procedures With Their Interpretation, Volumes I and II by *R. B. H. Gradwohl, M. D., D. Sc., Director of the Gradwohl Laboratories and Gradwohl School of Laboratory Technique.* Third edition. 2,130 pages with a 100-page index in each volume. 726 text illustrations in both volumes and 57 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $20.

Fifty years ago the laboratory was a diagnostic aid in swaddling clothes. Bacteria had been identified, simple stains were in use, primaries of blood counting were established, the Widal test was the pioneer in agglutination reactions.

Mallory and Wright had to labor to fill a small volume of a few hundred pages on bacteriologic and pathologic technic. Urine work consisted of simple chemical tests and inspection of the microscopic field.

The bedside, the amphitheater, the operating room represented an overpowering percentage of medical instruction and clinical recourse. Students were flocking to the laboratories, of course, and the flame of research was being fanned to brilliance.

Today, what would the medical man consider his main prop in diagnosis? Would it be the bedside, the stethoscope, the personal acuity of finger, of ear, and of judgment; would it be the illuminating light of the x-ray; would it be the operating room (confirmatory) or the necropsy table (regrettable); or would it be the laboratory?

Probably the answer would be the latter—which should be regrettable, as diagnosis in most diseases should be corroborated by the test-tube and microscope, rather than initially so made. But the volume of laboratory aids has become so immense that almost any mooted point can be referred to that final dictum.

The volume in hand, or rather volumes, cover 2,130 pages, plus a small-type index of 100 pages more. The phrase "last word" in such and such, is always overplayed, but will have to be used here. All procedures needed and imaginable have apparently been considered, and in a phraseology understandable by surgeon and internist. Type

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and paper are pleasing and stable; illustrations sufficient. Many pages are devoted to toxicologic technic, to crime detection procedures, to quantitative alcoholic tests of blood and urine. The Rh factor is elaborated upon, and even such a current development as penicillin is amply covered. Four hundred pages are given to parasitology and tropical medicine. And it is needless to say that all the usual laboratory methods are presented with magnificent detail and clarity.

HANDBOOK OF TROPICAL MEDICINE, by *Alfred C. Reed, M. D., Associate Clinical Professor of Medicine, Stanford University School of Medicine;* and *J. C. Geiger, M. D., Director of Public Health, San Francisco, California.* 188 pages. Stanford University Press, Stanford University, Calif., publishers, 1943. Price $1.50.

This book is an abbreviated handbook of 188 pages. It is pocket-size and bound in paper with a waterproofed cloth surface.

In general, the therapeusis of the various diseases is well covered and adequate. However the discussions of diagnostics are inadequate. A surprisingly small amount of space is devoted to the consideration of the malarias. The section on jungle yellow fever is weak and entirely inadequately handled. The rickettsias are somewhat confusedly presented, and the newer knowledge of louse repellents and technics of delousing clothing with fumigants is ignored. The discussion of the helminthiases is particularly inadequate.

Unfortunately numerous errors appear in the text, such as the statement that kala-azar is transmitted by Stomoxys and Simulium, that the spleen is *the* reservoir of plasmodia, that the prevention of blackwater fever is synonymous with the prevention of subtertian malaria, the implication that plague is transmitted by insects other than fleas, the mention of but two species of fleas (Xenopsylla cheopis and X. astra (sic!)), as plague vectors, and certain important details of the life histories of helminths.

It is to be regretted that a considerable portion of the text material is reduced to such a degree that the value of the book is seriously curtailed.

TEXTBOOK OF THE EAR, NOSE, AND THROAT, by *Francis L. Lederer, B. Sc., M. D., F. A. C. S., Professor and Head of Department of Laryngology, Rhinology, and Otology, University of Illinois College of Medicine, Chicago;* and *Abraham R. Hollender, M. D., F. A. C. S., Assistant Professor of Laryngology, Rhinology, and Otology, University of Illinois College of Medicine, Chicago,* 595 pages; 170 illustrations. F. A. Davis Co., Philadelphia, Pa., publishers, 1942. Price $6.

As stated in the preface, this book is written primarily for the medical student and as such furnishes an easily understood, concise textbook for this purpose. There are many excellent illustrations, a number of them in color. The color plates showing the various vocal cord conditions are very good. There is a good review of anatomy

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and physiology for the ear, nose, and throat. The more common disease conditions are discussed concisely under the headings of etiology, pathology, symptoms, diagnosis, and treatment, and the rarer conditions are described in a brief manner. There is a short discussion of the trachea and esophagus and of endoscopy as related to them. Speech disorders are also discussed briefly.

The new edition has a coauthor, has been rearranged, and has been streamlined considerably, which, in spite of the general briefness, has in this reviewer's opinion definitely improved it as a textbook for students. The book also contains general information of value to those not primarily interested in or specialists in this field.

RECONSTRUCTIVE SURGERY OF THE EYELIDS, by *Wendell L. Hughes, M. D., F. A. C. S., Hempstead, New York.* 160 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $4.

The author includes in this small monograph his own methods for the repair of the various deformities resulting from accidental or surgical absence of all or portions of the lower and upper lids, together with a critical analysis of previous procedures, a comprehensive bibliography, and a detailed index. The operative interventions are adequately clarified by case reports and numerous illustrations.

The appearance of this volume in wartime is timely as such deformities not infrequently result from combat, and plastic surgery is not only cosmetic, but often necessary as a sight-saving measure. Surgeons familiar with the contributions of Hughes through their previous publication in the periodical literature can testify to their value, and will be happy to have this volume in which the details of technic are so readily available.

BIOLOGY OF ACARUS SCABIEI, by *Reuben Friedman, M. D., Associate Professor of Dermatology and Syphilology, Temple University School of Medicine.* 183 pages with 112 illustrations. Froben Press, New York, publishers, 1943. Price $3.

The author has devoted about half of this book to an interesting critical review of the literature of the human itch mite beginning with the observations of Thomas Moffet in 1590 and including the classical contributions of Hauptmann, Entmüller, Grendielius, Bonanni, Schweibe, Linnaeus, Wickmann, Bonomo, de Geer, Alibert, Beaude, Vogel, van Leeuwen, Kraemer, Gervais, Simon, Wedl, Fürstenburg, and many others. Interest in this portion of the book is enhanced by the excellent reproductions of many of the figures and illustrations of the early authors.

The name, Acarus scabiei, is accepted and used throughout the book in spite of the fact that Sarcoptes scabiei has been accepted by modern medical parasitologists as well as by the International Commission on Zoological Nomenclature (Opinion Number 113).

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About 70 pages are used in description of the anatomy and biology based largely on the investigations of Buxton, Munro, Warburton, and the author. There are good discussions of each phase of the life cycle with ample illustrations. Particularly commendable are the author's photomicrographs of the various stages of the life cycle including sections of the skin showing the mite in its natural habitat.

The book is excellently illustrated; it is printed with large type on a good grade of paper. Above all it is very readable.

NUTRITION IN HEALTH AND DISEASE, by *Lenna F. Cooper, B. S., M. A., M. H. E., Chief, Department of Nutrition, Montefiore Hospital, New York City; Edith M. Barber, B. S., M. S., Writer and Consultant, Food and Nutrition;* and *Helen S. Mitchell, B. A., Ph. D., Chief Nutritionist, Office of Foreign Relief and Rehabilitation Operations, State Department.* Ninth edition, revised. 716 pages; 90 illustrations and 7 colored plates. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1943. Price $3.50.

This text has been kept up to date by constant revision and addition of new material, thus making it one of the excellent books in the field of nutrition.

Of special interest in this edition is the chapter which deals with food and nutritional problems during wartime, together with a summary of vitamins, including those less well known with their physiologic significance; and unusual photographs in color showing the results of vitamin deficiencies. The final section is devoted to tabular material and special tests.

The table of food values is of particular interest in that it contains the approximate composition of foods, their vitamin content, classification of carbohydrate value, and various other instructional food charts.

The completeness of this well-bound edition makes it a valuable reference book.

DISEASES OF THE NEWBORN, by *Abraham Tow, M. D., Adjunct Professor of Pediatrics, New York Polyclinic Hospital and Postgraduate Medical School.* 477 pages; 53 illustrations. Oxford University Press, New York, publishers, 1943. Price $6.50.

During the past 10 to 15 years there has been a growing and enthusiastic interest in the newborn. This has been a timely parallel to a rising birth rate and the welcomed decline in maternal and infant mortality. Probably a goodly portion of the 3,020,000 babies born in 1942 are of Naval personnel and many Naval dispensaries are actively interested in this important period.

This volume attempts to present its material logically under the various systems. Most of the discussion is on the clinical side with adequate description of the more common diseases. Good illustrations and many descriptive photographs are helpful to the reader. The author has borrowed from the contemporary literature and in so doing has made his volume more serviceable.

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Considerable advance has been made in recent years in the field covered by this book and we look forward with interest to a new edition.

PHARMACOLOGY, MATERIA MEDICA AND THERAPEUTICS, by *Charles Solomon, M. D., F. A. C. P., Associate Attending Physician and Chief of the Medical Clinic, Jewish Hospital of Brooklyn.* Fifth edition. 823 pages; 91 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1943. Price $3.25.

The fact that this is the fifth edition in 9 years should be sufficient recommendation for this volume. Although written primarily for nurses, there is adequate material for all physicians. Dr. Solomon's method of presentation should also prove helpful to hospital corpsmen.

The writer begins his book with a comprehensive chapter in which he (1) defines the fields of pharmacology and materia medica, (2) criticizes use of proprietary and patent medicines, (3) explains the limitations of the food and drug act especially in the lack of control over "harmless" analgesics and hypnotics and, (4) stresses the absurdity of self treatment of constipation, obesity, underweight, common cold, and other of the more common diseases of high morbidity but low mortality.

There is a brief outline of the altered physiology and pathology in disease.

Of particular value are the illustrations and outlines for the administration of drugs which are not included in many books on therapeutics.

The author has used excellent judgment in the amount of space allotted to the various systems and has used this as a basis for following his theme. The material is up-to-date and includes protamine zinc insulin, the sulfonamides, and prostigmine.

In addition, to enhance the use as a textbook, there are listed series of questions at the end of each chapter.

It is the reviewer's belief that a more comprehensive index could have been an added feature. However this is a minor criticism and is offset by many other features.

AN INTRODUCTION TO SOCIOLOGY AND SOCIAL PROBLEMS, A Textbook for Nurses, by *Deborah MacLurg Jensen, R. N., B. Sc., M. A.; Instructor in Sociology and Social Problems at Schools of Nursing of St. Louis City Hospital and St. Luke's Hospital.* Second edition. 420 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $3.25.

This book is an excellent nontechnical treatise on sociologic problems for students of nursing. It is profusely illustrated with drawings, charts, and photographs. The book is organized like its more technical forebears into Personality Development in Social Groups; Social Institutions in General and the Family in Particular; and Community and Social Change. The reasonably brief bibliography

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which concludes each section should prove helpful to those students of nursing who are interested enough in the subject to look further afield than the prescribed textbook.

The section devoted to social planning is of particular interest in its outlining of the all too poorly understood Social Security Act. The inclusion of a brief summary of the Beveridge Report is a further excellent feature of this section. These difficult and controversial matters are presented with an objective balance not often encountered in popular works.

The list of agencies, appearing for the first time in the present edition, is too brief to have a practical value. It might well be supplemented and more carefully organized by grouping in future editions.

ORAL DIAGNOSIS WITH SUGGESTIONS FOR TREATMENT, by *Kurt H. Thoma, D. M. D., Professor of Oral Surgery and Brackett Professor of Oral Pathology, Harvard University; Oral Surgeon and Chief of Dental Service, Massachusetts General Hospital.* Second edition, revised. 495 pages with 666 illustrations, 63 in colors. W. B. Saunders Co., Philadelphia, Pa., publishers, 1943. Price $6.75.

A considerable number of chapters of this book open with an outline of the contents which is helpful to the reader, who can see at a glance whether he will find the information he seeks in a given chapter. At the end of the book we find a glossary of terms in general use, a bibliography that corresponds to the chapters in the text proper and a comprehensive index. A more complete bibliography would enhance its value. The book has a good binding as befits the fine quality of the paper and the accompanying well-prepared black and white illustrations. The table adds to the usefulness of the book.

The contents of the book as a whole are divided into three main parts, dealing respectively with: (1) The theory of diagnosis and treatment planning; (2) methods of examination; and (3) clinical diagnosis of dental and oral diseases. With respect to theory, the traditional approach is followed in that emphasis is placed on the need of thorough knowledge of scientific and systematic handling of data of anatomy, physiology, and pathology in the study of disease, with little more than a cursory reference to the philosophy of dentistry in its modern setting.

The section on examination presents a more detailed analysis of the part that the case history, the physical examination, laboratory tests, and the roentgen examination play in the examination of dental patients. Too little attention is given to case recording, a subject to which more attention has been given recently. Section three deals with dental and oral diseases that may now be considered under the scope of clinical dentistry known as "oral medicine," or the nonsurgical diseases of the mouth. Each disease is discussed under etiology, symptomatology, roentgenographic interpretation, etc. In

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this section is also included a discussion of dental caries, paradental diseases, pulp and periapical involvement and consideration of some surgical oral conditions.

APPLIED ANATOMY OF THE HEAD AND NECK, For Students and Practitioners of Dentistry, by *Harry H. Shapiro, D. M. D., Assistant Professor of Anatomy, College of Physicians and Surgeons, Columbia University.* 189 pages with 173 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1943. Price $5.50.

This book emphasizes the value of utilizing an intimate knowledge of anatomy in the practice of various branches of dentistry. This is accomplished by the presentation of significant features of developmental, descriptive, surface, and special anatomy with consideration of the uses to which such knowledge may be put in operative dentistry, prosthodontia, orthodontia, oral surgery, and radiodontia.

As is to be expected in a book of this type, many illustrations are taken from standard works on anatomy and much of the matter covered may be found in texts on anesthesia, oral surgery, orthodontia and oral pathology. Nevertheless, the correlation of original and derived material is done so effectively that the book should be of considerable value to any dental practitioner.

The chapter on musculature, which incorporates a discussion of the role played by the muscles of expression and mastication in malocclusion and fractures, will repay careful reading.

Typography is excellent and illustrations, with the exception of the photographic reproductions, are numerous, well selected, and good. The bibliography is sufficiently adequate to enable interested readers to obtain more detailed presentations of related works.

KINETIC BANDAGING, Including Splints and Protective Dressings, The Kinetic Method of Visual Teaching, by *Seymour W. Meyer, B. S., M. S., M. D.* 310 pages with 540 illustrations. F. A. Davis Co., Philadelphia, Pa., publishers, 1943. Price $3.50.

Simplicity is the keynote of this excellent volume on bandaging and the author, by including over 500 figures and charts in the 310 pages, has shown his keen appreciation of visual aid in the instruction of the uninitiated into the art of good bandaging.

By starting with the elemental basic terms which he applies to the geometric configuration of the body, he attains an advance over most teachers in bandaging by illustrating that a good bandage is not usually constructed with one basic turn but is a combination of several.

There are excellent chapters dwelling in detail on all types of dressings, emergency and definitive. Included also are chapters on plaster of paris and splints.

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He has also included a very practical method of presenting his subject which should be of value to instructors in the art of bandaging.

The text is well bound and neatly arranged in large-size print which makes for easy reading.

THE MICROSCOPE AND ITS USE, by *Frank F. Munoz, Technical Microscope Consultant;* in collaboration with *Dr. Harry A. Charipper, Professor of Biology, New York University.* 334 pages; illustrated. Chemical Publishing Co., Inc., Brooklyn, N. Y., publishers, 1943. Price $2.50.

Starting off with its history, this book makes almost a fictional record of one of science's most valued instruments, the microscope. Because of its completeness, including illustrations, descriptive details and references to accessories such as lamp and camera, it becomes imperative reading for all microscopists. Even those who are skilled and practiced in the art of microscopy will find many hints and suggestions which will improve their technic.

Among more specific recommendations are the following: (1) A whole chapter on illumination alone; (2) another on the closely associated microtome, which is unusually complete; (3) a third on the use and care of the microscope, which will be most worth-while in the present emergency when there is a shortage of production; and (4) clarifying data on such items as the metallurgical and polarizing microscopes. The volume is concluded with a list of the more common errors of usage and a glossary of terms.

THE MEDICAL AND SURGICAL SECRETARY, by *Queena Hazelton.* First edition. 358 pages. McGraw-Hill Book Co., Inc., New York, publishers, 1943. Price $2.

This is one of the latest books available for the training of medical secretaries and is designed primarily for vocabulary and terminology building.

The book has been arranged in 45 lessons including the medical shorthand outlines in the Gregg system and definitions for many medical words. The typography and spiral binding make the book easily read and handled.

For those students familiar with medical subjects, the presentation of the material appears to lack systematic arrangement. In lesson one, for example, while a list of suffixes and prefixes are presented, the technical review contains words for which no explanation has been given. The dictation material, instead of being simple case histories is largely dictionary definitions, which are in several instances not complete and give rise to questions in the mind of the reader.

Exceptions are noted in many parts of the text from the fundamental precepts of Gregg shorthand, which detract from the educational value of this book.

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In this reviewer's opinion this work would be greatly enhanced as a textbook if it were rearranged in progressive sequence, beginning with the prefixes and suffixes as the author has done, but using the simpler words that carry these and progressing to more difficult ones. In addition more case-history dictation material of the type usually found in average medical dictation would give students the opportunity to associate medical terms with ordinary everyday English. This would tend to give students more confidence in taking medical shorthand under actual dictation circumstances.

For students in recognized schools for the training of medical secretaries this book would be of value as a reference text for vocabulary building.

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DEMEROL IN INTRACRANIAL LESIONS

Twenty patients with intracranial lesions were given demerol parenterally in therapeutic doses on one or more occasions. In 7 of the 20 patients the respiratory rate fell from the usual rate of 18–22 per minute to 12 per minute or less. In 5 patients respirations fell to 12 per minute, in 1 patient to 8 per minute and in another patient to 4 per minute. Also instances of contracted pupils with sluggish response to light were observed.

It is felt that, from the data which are at hand, demerol should be administered with caution, if at all, to patients with intracranial lesions.—GUTTMAN, S. A.: Demerol; caution in administration to patients with intracranial lesions. J. A. M. A. 124: 155-157, January 15, 1944.

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SUBLINGUAL ADMINISTRATION OF DRUGS

The sublingual administration of drugs is a simple and, at times, an advantageous technic for those few drugs with an adequate degree of penetrability. The majority of drugs, however, do not penetrate the oral mucosa in significant amounts, and it is unsound practice to rely on this technic with any drug whose effectiveness by this route has not been conclusively demonstrated.

Drugs which penetrate the oral mucosa readily are organic nitrates, steroid hormones, androgens, estrogens, anhydrohydroxyprogesterone, desoxycorticosterone acetate, vitamins, alkaloids such as apomorphine, nicotine and cocaine.

Drugs which do not penetrate the oral mucosa in any practical dosage are morphine and its derivatives as codeine, and dilaudid, ergot alkaloids, autonomic drugs as atropine and mecholin, barbiturates, analeptics as strychnine and picrotoxin, cardiac glucosides, and insulin.—WALTON, R. P.: Sublingual administration of drugs. J. A. M. A. 124: 138–143, January 15, 1944.

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PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

FEVER THERAPY IN CHEMORESISTANT GONOCOCCUS INFECTIONS

AN ANALYSIS OF 150 CONSECUTIVE CASES

GORDON M. PERISHO
Lieutenant Commander (MC) U. S. N.

In 1937 and 1938, when the first reports on the use of sulfanilamide in the treatment of gonorrhea were published, a wave of enthusiasm and optimism developed among the profession regarding its significance relative to the problem of gonorrhea. Five years of experience with sulfonamide drugs, including the development of more effective formulae than the original sulfanilamide, has tempered our early enthusiasm somewhat and left the gonorrhea problem not entirely solved. However there is no question but that chemotherapy has been of enormous benefit in reducing time loss from gonorrhea. It has also brought about a change in the methods of handling gonorrhea in the Navy.

In the presulfonamide era, most cases of gonorrhea were hospitalized where facilities were available, especially on shore stations, and patients were kept there until clinically well and able to return to duty. The present trend in the Navy is not to hospitalize early cases of gonococcus infections, as experience has shown that the majority of cases will clear up promptly under chemotherapy. Hospitalization is reserved for those cases that fail to show evidence of cure, either through sensitivity to sulfonamides with toxic reactions, or through having been infected by a so-called chemotherapy-resistant strain of gonococcus.

We are now faced with the problem of a seemingly irreducible percentage of gonococcus infections that are incurable by chemotherapeutic methods. Statistics vary regarding the exact figures on the percentage that fail to clear up after a reasonable trial with sulfonamides, but they probably range between 10 and 15 percent of all new infections.

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It is this group of cases that the hospitals are called upon to treat and make proper dispositions. These patients have had their infections for a long time, often as long as 9 or 10 months, have been transferred from place to place, many have developed complications such as prostatitis, epididymitis, and arthritis, and as a group their morale is extremely low. Most have been on a "misconduct" status with loss of pay since the onset of their infection. From an observation of this group, one is forced to conclude that the question of what constitutes "a reasonable trial with chemotherapy" before a patient shall be classed as chemotherapy-resistant is one that is far from settled in the minds of physicians. Most cases admitted to this hospital have received many courses of sulfonamides of all types, and often with rather astounding totals of dosage. One patient had taken over 900 tablets (7½ grains) prior to admission, and totals of 400 to 500 tablets were not uncommon. It is felt that if a patient has not clinically recovered after 10 to 15 days of sulfonamide therapy, or at least shown marked clinical improvement in this period of time, little or nothing will be accomplished by persisting in chemotherapy, and it should be abandoned in favor of other methods of treatment.

TECHNIC

This report is based on the experiences gained with fever therapy in the treatment of gonococcus infections of the type described above, at a new Naval hospital. As soon as the problem became apparent, the chief of the urologic service and the chief of the physical therapy and fever therapy service worked out a plan for treating chemotherapy-resistant gonococcus infections by fever therapy, and it was agreed that a sufficient number of cases would be treated by a predetermined plan, in order to evaluate its worth before making any major changes in the methods used. This is a report on the results of treating 150 consecutive cases by this method.

As all recent experience has shown that the single long session at high temperatures provides the greatest percentage of cures, this method was adopted. In each case, an attempt was made to produce a sustained fever of from 106° to 106.8° F. for 8 hours.

A detailed account of the technic used will not be given as it is essentially the same as described by other fever therapists, including Krusen (*1*), Tayloe (*2*), and Turville and Fetter (*3*). All candidates received a careful physical examination, routine laboratory tests, electrocardiogram, and teleroentgenogram of the chest before fever therapy. Each case received sulfadiazine or sulfathiazole for 48 hours before, and 48 hours after fever therapy. The character of the treatment and the discomforts to be expected were carefully explained to each candidate, and the fact that fever therapy was purely volun-

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tary was stressed. On the other hand, it was found necessary to warn each candidate that if he volunteered to submit to fever therapy, and if he were removed from the cabinet because of his failure to cooperate, prior to completing 8 hours of fever, he would be denied the benefit of further fever therapy. This was done in order to discourage the more emotionally unstable patient from volunteering to try fever therapy, with the mental reservation that if he found it not entirely to his liking, he would set up an emotional display that would assure his removal from the cabinet.

RESULTS

Of the 150 consecutive cases on which one or more fever therapy sessions were attempted, at least one 8-hour session of therapeutic fever sustained at a rectal temperature of from 106° to 106.8° F. was obtained in 125 cases.

Of these 125 cases, 121 were clinically cured. The 4 failures were discharged from the hospital clinically cured, but were readmitted at a later date with a recurrence of the infection. All 4 patients vigorously denied the possibility of their recurrence being a newly acquired reinfection.

Of the 121 clinical cures obtained from 8-hour fever sessions, 107 resulted from a single session. The remaining 14 required in addition to one full 8-hour session, one or more repeat sessions. No patient in this group received more than 3 sessions and the total hours of 106° F. fever did not exceed 20 hours in any case.

It is interesting to note that, in spite of failure to complete 8 hours of sustained fever of 106° F. in these 25 cases, 19 of these patients were cured of their gonococcus infections sufficiently soon after their fever treatments so that fever can be credited with having contributed toward the cure.

Thus of the 150 cases treated by fever therapy, 137 cures resulted, or 91.3 percent of all cases treated were cured. Of the 125 cases receiving one or more satisfactory 8-hour sessions, 96.8 percent were cured. However of the 25 cases receiving less than a full 8-hour session of 106° F., only 64 percent were cured. This of course is a strong argument in favor of the long sessions of high fever.

ANALYSIS OF FAILURES

Most of the failures to obtain a satisfactory 8 hours of sustained fever of 106° F. or more can be attributed to abnormal emotional or hysterical reactions which necessitated removal of the patient from the cabinet before the session was completed. A few developed acute psychoses of a maniacal type, necessitating terminating the treat-

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ment. These cases will be discussed in further detail under complications.

Two of the patients are of particular interest. In both of these cases, in spite of heroic and repeated attempts, it was impossible to raise the rectal temperatures to a level even approaching 106° F. One was a fireman, second class, who had had several months' duty in the engine room of his ship, working in an environment of high temperatures and high humidity. The second patient had been transferred from another hospital where he had received several short sessions of fever therapy (3 to 4 hours at temperatures of from 103° to 105° F.) for his gonococcus infection, without benefit.

It appears that in both of these men, their body heat regulating mechanisms had become acclimated or adapted to high environmental temperatures, rendering them extremely resistant to artificially induced fever.

Recent studies by both the British and the United States Armies in conditioning troops for desert and tropical warfare, casts some light on this problem. It has been found that efficient work in hot climates depends on physiologic adaptation—decrease in heat production and increase in sweating. When the body reaches a certain critical temperature just below 102° F., work becomes inefficient and hyperthermia threatens. Acclimatization is marked by a progressively smaller rise in body temperature for performing a standard piece of work, until those completely acclimatized can work for long periods without rise to the critical level, provided the intake of salt and water is adequate (*4*). It will be interesting to learn of the experiences at desert training centers, in treating these "acclimatized" men with fever therapy.

COMPLICATIONS

The usual mild or serious complications encountered in fever therapy, and their management have been adequately discussed in others (*1*) (*2*) (*3*) and will not be considered in this paper. However a few unusual experiences were encountered that warrant comment.

Patients developing acute psychoses during fever sessions, as noted above, were a major problem. The psychosis would develop abruptly, usually toward the end of the session, and in patients who had been quiet, cooperative, and uncomplaining up until the onset of delirium. The patient would suddenly become violently maniacal, hallucinated and completely disoriented toward his environment. Removal of the patient from the cabinet and reduction of body temperature brought about a rapid subsidence in the symptoms. All patients, on return to a normal mental state, had a complete amnesia for the episode. No permanent ill-effects were noted.

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Our experiences with drug sedation suggest a possible aid in reducing the incidence of psychosis. In the first 100 cases treated, each patient was given 1 grain of codeine by mouth 15 minutes before entering the fever cabinet, and no additional sedation was given, unless the patient showed more than the usual degree of restlessness or discomfort. In those cases, morphine, ⅛ grain, was administered hypodermically, occasionally repeated. This procedure caused no apparent reduction in the incidence of psychoses. The procedure was then changed. Each patient, in addition to receiving 1 grain of codeine before beginning the fever session, was given ⅙ grain pantopon hypodermically as soon as his temperature reached 106° F., and this dose was repeated 4 hours later. Since this routine was adopted, we have had no psychoses develop. The series is too small to predict that the problem has been completely solved, but to date the results are encouraging.

An unusual and interesting complication occurred in four patients, concerning which no previous reports have been noted. Within 18 hours after their fever session these four developed a severe acute epididymitis, although none of them had had this complication prior to fever therapy. In all four the epididymitis completely subsided within 48 hours, together with all other clinical signs of gonorrhea, and a complete cure resulted. A postfever-therapy epididymitis is considered a highly favorable prognostic sign.

It was impossible in two cases to confirm the experience reported by Pruce (*5*) in the successful treatment of shock during fever therapy by the use of intravenous human plasma. Both patients developed signs of shock with peripheral vascular collapse, rapid pulse, and lowered blood pressures, in the ranges of 70/40 and both failed to maintain satisfactory blood pressure levels with the usual measures recommended, including intravenous saline, 5-percent dextrose solutions, oxygen inhalations, etc. In both patients an intravenous infusion of 500 cc. of serum plasma was followed by a prompt and sustained return of blood pressure to normal ranges, and no further trouble ensued. The use of serum plasma in fever therapy shock is a major contribution in safeguarding patients from a serious and possibly fatal complication.

COMMENT

From recent reports it would appear safe to predict that in the future penicillin will replace fever therapy as the method of choice in treating chemotherapy-resistant gonorrhea. Certainly from results obtained in the few cases treated by penicillin, it would appear to be far simpler, safer, and considerably less trying on the patient than fever therapy, as well as being much less expensive and more

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universally applicable. For the immediate future, however, the difficulties in mass production of penicillin, and the tremendous demand for all available supply for use in treating war wound infections and other more serious infections, preclude its use for the large majority of cases of chemotherapy-resistant gonococcus infections, and fever therapy will continue for the present to be the best means of rehabilitating these unfortunates. Further, as Krusen (*6*) suggests, we may in the future encounter penicillin-resistant, chemotherapy-resistant gonococcus infections that will require fever therapy for relief.

CONCLUSIONS

1. Chemotherapy-resistant gonococcus infections are a serious problem in Naval hospitals, and are a cause of a large number of man-hours lost from the armed forces.

2. A reasonable trial with sulfonamides in gonococcus infections should not exceed 15 to 20 days, after which chemotherapy should be abandoned in favor of other methods of treatment.

3. One hundred and fifty cases of chemotherapy-resistant gonococcus infections were treated with artificial fever therapy, with 91.7 percent cures.

4. On 125 of these cases, a sustained fever of from 106° to 106.8° F. for 8 hours was produced, resulting in 96.8 percent cured.

5. In properly equipped institutions and with trained personnel, fever therapy offers the best present method of rehabilitating chemotherapy-resistant cases of gonorrhea.

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BLOOD PRESSURE AND PENTOTHAL

The interesting fact was noted that if pentothal in 5–10 percent solutions (say, 3–5 c. cm.) is injected quickly a prompt fall in blood pressure occurs, which gradually recovers as the respirations strengthen. The safe rate of injection is 1 c. cm. per half-minute.—DODD, H.: Significance of blood-pressure readings in general surgical work; with special reference to cardiac index. Brit. M. J. 2: 811–813, December 25, 1943.

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ARTHROPOD-BORNE DISEASES IN MICRONESIA [1]

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Micronesia, although geographically tropical, and climatologically semitropical to tropical, has strangely enough escaped to a large degree the ravages of both tropical and temperate arthropod-borne diseases. Superficially this appears to be explainable on the basis of the common biogeographic experience which invariably finds oceanic islands poor in variety of species. This would seem to account, in the case of Micronesia, for the absence of Anopheles, Flebotomus, etc., which occur on the continental islands and the mainland of Asia. In general the species occurring on oceanic islands, such as Micronesia, are hardy ubiquitous forms, such as Aëdes aegypti (L.), or forms derived from them. However, in addition to geographical isolation, other factors such as the climatologic, ecologic, and ethnographic may also be important in explaining the absence of certain arthropods as well as certain pathogenic organisms transmitted by arthropods.

Because of the wartime conditions of rapid communications and mass transportation of personnel and matériel both by air and water it seems wise to re-examine critically the available information on the arthropod-borne diseases of Micronesia. Consideration should be given not only to conditions as they existed prior to the war but also to the possibility of the introduction of the necessary vectors or pathogenic organisms or both. Mumford and Mohr (*35*) (*36*) have listed noncritically many of the records of arthropod-borne diseases as reported in the literature; these papers are useful sources of empirical data. The material upon which this discussion is based is derived primarily from American, German, and Japanese reports and papers and is unavoidably fragmentary in nature. Furthermore many of the papers are sufficiently old so that conditions may possibly have changed considerably since their publication. Consequently errors, both of commission and omission, have doubtlessly been committed in this article. It is hoped that in spite of such shortcomings it will be useful in showing the potential problems indigenous to the area and even further in indicating the necessity for certain investigations and control measures.

FILARIASIS

Filariasis, caused by Wuchereria bancrofti, apparently has a general distribution throughout the Micronesian Islands, although its

[1] Micronesia, as used in this paper, includes the Marshalls, Marianas, and Carolines.

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actual incidence is probably very low. Matsumoto (*29*) does not regard it as an important disease of the Mandated Islands. The *South Sea Islands Handbook* (*52*) published by the Japanese Government does not even mention filariasis among the diseases of the Mandated Islands and the reports of the Japanese Government to the League of Nations do no more than to record a few scattered cases. Esaki (*12*) suggests that filariasis has been introduced from the Loochoo Islands but goes further to say that no cases have been reported from Micronesia. This does not agree with the official reports from the Japanese hospitals nor with German and American reports. In 1913 von Prowazek (*49*) in an extensive discussion of the diseases of the Marianas Islands did not mention filariasis except to state that it is common among the immigrants from Samoa. Because of the numerous migrations of the natives it is difficult or impossible to ascertain which cases are actually autochthonous and which are imported. Particularly important in this respect are the constant immigrations from Samoa and Loochoo.[2] In the Samoan area Dickson et al.[3] reported a microfilaria index of 13.6 percent among the native adults of Tutuila, and Belding[4] (source not disclosed) cites a 27-percent index among the adult natives of Fiji. Kackley[5] reported a microfilaria index of 10 percent among adult natives of Funafuti in the Gilberts. Indices as high as 60 percent have been reported elsewhere in the Gilberts. Ohama (*37*) (*38*) and Yosino and Nakasoto (*51*) have reported indices of 6 to 29 percent in the Loochoo Islands (fig. 1). Crow (*11*) was of the opinion that the filariasis observed by him on Guam in 1910 was contracted there, although he thought it had been introduced previously (about 1870) from the Carolines by imported laborers. Salecker[6] also found filariasis among the Samoan immigrants on Saipan.

The first definite record of filariasis in Micronesia appears to be that of Born (*3*) who in his report of 1906–7 states that he found it on Yap, Palau, and Woleai in the West Caroline Islands. Previously cases of elephantiasis were reported by Born (*2*) from Yap; Girschner (*16*) from Nukuoro Island near Ponape, East Carolines; and Krämer (*24*) from Truk where it was noted not to be widespread. Other reports of cases of elephantiasis during the German period in Micronesia have been recorded by Girschner (*17*) (*18*) from Ponape; by Schnee (*42*) from Saipan, Marianas Islands; Buse (*8*) from Yap; Mayer (*31*)

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[2] Although it is not suggested in the literature, it seems logical that some cases may have been introduced from New Guinea where filariasis is endemic (fig. 1).

[3] DICKSON, J. G.; HUNTINGTON, R. W., Jr.; and EICHOLD, S.: Filariasis in defense forces. Samoan group; preliminary report. U. S. Nav. M. Bull. 41: 1240–1251, September 1943.

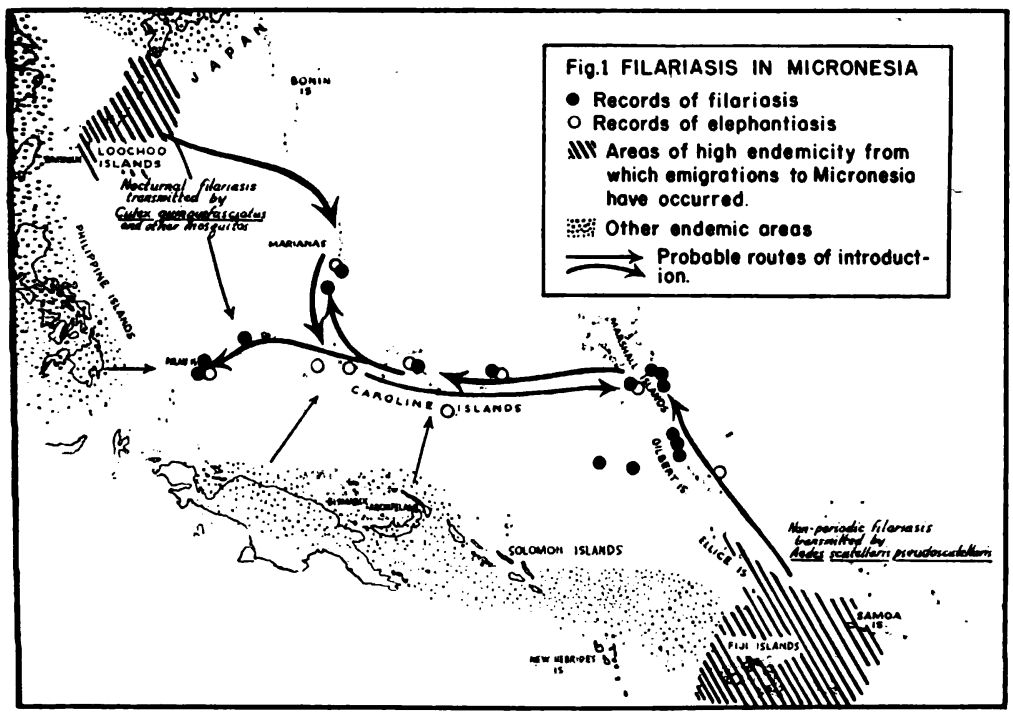
[4] BELDING, D. L.: Textbook of Clinical Parasitology. D. Appleton Century Co., 1942. p. 360.

[5] Sanitary Survey of Funafuti Atoll, January 20, 1943.

[6] SALECKER: Die Verbreitung der Tuberculose auf den Marianen. Arch. f. Schiffs u. Tropenhyg. 19: 369–376, 1915.

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from Ponape; Müller (*32*) from Yap; and Krämer (*25*) from the Lamotrek group, East Caroline Islands (records of 1908 to 1910). Crow (*11*) who conducted a filariasis survey in Guam in 1910 found microfilariae only in the natives of Inarajan. The microfilaria index was about 10 percent. Kindleberger (*22*) speaks of 12 cases of filariasis "up to this time" (1911) in Guam. Since 1911 the literature and reports from Guam contain no records of filariasis or elephantiasis.



Born (*4*) (*5*) stated that filariasis was found on Jaluit, Majuro, Arno, and Mili (Marshall Islands) but that it was not found on Ebon Atoll. Buse (*7*) recorded the treatment of 6 cases from Angaur in the Palau group. The Japanese reports (*54*) list the following number of cases of "filariasis and elephantiasis" treated in the Mandated Islands: 10 in 1924, 8 in 1925 (Saipan, Angaur, Truk, Ponape, Jaluit), 9 in 1926 (Saipan, Truk, Ponape, Jaluit), 10 in 1927, 11 in 1928, and 6 in 1929. In 1929 reports on filariasis were discontinued.

Whether the filariasis of Micronesia is nocturnal or nonperiodic is conjectural. In view of suggestions of Esaki (*12*) (*13*), von Prowazek (*49*), Crow (*11*) and others concerning its introduction it is likely that both occur (fig. 1). That introduced from the Loochoo Archipelago would be the nocturnal type borne by Culex quinquefasciatus Say (=fatigans Wiedemann), whereas that introduced from Samoa would be the nonperiodic type borne by Aëdes scutellaris pseudoscutellaris (Theobald), a diurnal species. Attention should be drawn to the fact that nocturnal filariasis has been reported in the Gilbert

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Islands, which may indicate a wide distribution of this type in Micronesia.

C. quinquefasciatus is a common mosquito throughout Micronesia. Swezey (*47*) records Aëdes scutellaris pseudoscutellaris from Guam and states that in 1937, A. Cruz "reared quite a lot of them from larvae in coconut hulls at Mogfog, Nov. 10." Apparently it is common on Guam, since it constitutes a large part of the Guam Culicidae collection in the U. S. National Museum. Curiously, Esaki (*12*) and Sogen (*44*) in the detailed discussions based on extensive collections of the mosquitoes in the Mandated Islands do not mention Aëdes s. psuedoscutellaris. Instead they speak of Aëdes albopictus as very numerous throughout Micronesia. This species, however, has never been recorded from Guam. Considering also the fact that Esaki was not certain of his identification of "albopictus" and that albopictus and scutellaris are similar biologically and morphologically, it seems likely that the "albopictus" of Esaki and Sogen is actually scutellaris pseudoscutellaris. The Japanese use of albopictus could well spring from the confusion in nomenclature in the English and Dutch literature over the use of albopictus, variegatus, and scutellaris, although this nomenclature has been clarified by Bonne-Wepster and Brug (*1*).

It appears on the basis of the available information that the following provisional conclusions can be drawn: 1. Filariasis occurs throughout Micronesia, although its incidence is very low. However, because of more or less constant immigrations from Samoa and Loochoo (fig. 1) where filariasis is extremely prevalent, it is not possible to ascertain to what extent the cases are imported and to what extent autochthonous. 2. It is probable that both the nocturnal and nonperiodic types occur. 3. C. quinquefasciatus, the vector of nocturnal filariasis, is a common mosquito in Micronesia, and Aëdes scutellaris pseudoscutellaris, the vector of nonperiodic filariasis, known with certainty to be abundant in Guam, may also be common throughout the area.

It is apparent that there is a need for investigation of filariasis and its transmission in Micronesia. Although experience in Guam has been to the contrary, these conclusions indicate the possibility that Naval personnel stationed on these islands could become infected. Since filariasis has already shown itself to be a disease of Naval importance in the Samoan area, it is suggested that consideration be given to a filariasis investigation as soon after occupation as practicable. Attention should be given to determining the presence or absence, and abundance if present, of Aëdes scutellaris pseudoscutellaris. This species as well as C. quinquefasciatus should be examined for infective filaria larvae. Attention should also be given to the matter of human reservoirs among the natives and whether their filariasis is of

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the nocturnal or nonperiodic type. Separate investigations for each island or group of islands where naval personnel are stationed will be necessary.

DENGUE

Dengue is certainly the most prevalent arthropod-borne disease in Micronesia. According to the *South Sea Islands Handbook* (*52*) "it breaks out periodically and spreads rapidly to almost all of the islands." The reports of the Japanese Government to the League of Nations (*54*) describe dengue as occasionally epidemic and always endemic. As in other areas it is primarily a disease of nonimmune newcomers. The suggestion of Esaki (*13*) concerning its recent introduction from the Loochoos does not appear tenable in view of the earlier German reports on the disease. However, it is obviously possible, because of the constant immigrations from Loochoo, that it could be introduced periodically via this route.

Many of the early German reports do not mention dengue, although it appears probable that cases of dengue were diagnosed and recorded among other diseases such as grippe. Sunder (*46*) in 1903 reported dengue as a "new disease" on Yap. The natives of Yap, however, were not affected, the disease being confined to the natives of Palau, Woleai (south of Yap), and Sonsorol (south of Yap). Dengue was reported from Jaluit in the Marshall Islands in 1906–1907 by Liesegang (*28*) and in Majuro, also in the Marshalls, in 1912 by Braunert (*6*). Buse (*7*) in his report on health conditions in Yap for 1911–1912 describes a dengue epidemic among Europeans of recent arrival. The disease, according to this account, was probably introduced from the Philippines, although it is stated that dengue-like fevers occur among the natives of Yap. Kindleberger (*22*) described an epidemic of dengue in Guam in 1911 which was probably introduced from the Philippines. Eighty-three enlisted men and 28 natives were admitted to the hospital. There were many other native cases. The disease has been reported sporadically from Guam (*53*) since that time, including epidemics in 1932 (104 cases treated) and 1939 (40 cases treated).

The best source of information on dengue in Micronesia is the paper of Sogen (*44*). According to this author the government hospitals treated 2,844 cases of dengue (2,388 Japanese and 456 natives) in the 13 years, 1927–1939. Because of the light course of the disease among the natives, it is to be assumed that many native cases did not come to the attention of the medical authorities.

The Japanese Government reported to the League of Nations (*54*) an epidemic on Palau, Saipan, and Angaur in 1927 with "more than 950 cases" and "more than 2,000 cases" in 1928 on Truk, Ponape, and Jaluit as a result of the expansion of the 1927 epidemic. The 1927–1928

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epidemic is also described by Matsumoto (*29*). Earlier Japanese reports speak of epidemics in 1918 and 1920.

There appears to be a definite tendency toward the appearance of dengue epidemics between July and November. Sixty-six percent of the cases reported from the Japanese government hospitals have occurred during these months. There is a tendency for the epidemics to follow periods of heavy rainfall. This would be correlated with the population of the vector, Aëdes aegypti L., which would naturally increase after such periods.

As is the rule elsewhere the death rate from dengue in Micronesia is low. A single death was recorded in 700 cases treated since 1929, whereas in the Loochoo Islands where dengue is very prevalent, there was a death rate of 1.34 percent in 35,129 cases in 1931. In about 75 percent of the cases which the Japanese have recorded from Micronesia the patients were between the ages of 15 and 40 and about two-thirds were males. The majority were first infections; reinfections are rare. About 67 percent were contracted within 6 months after arrival in Micronesia.

Sogen assumes that the vectors are Aëdes aegypti and albopictus. However, it is very likely that only the former is involved, since the "albopictus" of his data is probably Aëdes scutellaris pseudoscutellaris. Nevertheless, it is possible that albopictus may occur on some of the islands.[7] This should be determined by entomologic investigation after occupation.

Aëdes aegypti is a common mosquito throughout Micronesia. According to the data of Sogen (*44*) about 30 percent of the adults taken on Saipan, Yap, and Ponape are of this species. Apparently it is less common on the Palau Islands, although the observations are fragmentary. According to Esaki (*12*), "the daytime attacks of the two above-mentioned species (aegypti and scutellaris) are the worst nuisance in these South Sea Islands." They are especially numerous on Jaluit in the Marshall Islands. Both Fullaway (*14*) and Swezey (*47*) have found it common on Guam. Control of aegypti in Micronesia is difficult because of the incessant rainfall which provides a constant abundance of breeding places.

RICKETTSIOSES

There are no authentic records of any cases of rickettsioses of any type in Micronesia. In 1912 Wendland (*50*) in Herbertshoehe, New Britain, described 3 cases of typhus (Fleckfieber) from the *Planet* and the *Cormoran*, two German warships which had sailed from Ponape in the East Caroline Islands. Four milder cases were not

[7] Aëdes albopictus is an oriental species, although it has been introduced into Hawaii where it has become common. Other Polynesian records are apparently due to misidentifications or confusion in nomenclature.

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hospitalized. Wendland states that the disease was doubtlessly contracted at Ponape and that an investigation should be made to determine whether or not the disease occurred there. Prior to this time no cases of typhus were recorded and the subsequent German and Japanese reports likewise contain no records of typhus in Ponape. In consideration of the German nomenclature there can be little doubt that all references except that of Wendland are to typhoid fever (Typhus, Typhus abdominalis or Unterleibstyphus) rather than to typhus (Fleckfieber). It seems likely that the few cases of typhus reportedly recorded by the Japanese are actually typhoid fever, the German terminology being employed in the reports printed in English. This is a common usage in Japanese reports and papers.

A "Marshall-typhus" has been attributed to Kwajalein Atoll, Marshall Islands, in various compilations in this country.[8] No confirmation of such a disease of the typhus group can be found in either the Japanese or German literature on the Marshall Islands. It is possible that the disease involved may be typhoid fever. It is said to be characterized by a high fever of a month's duration and high fatality.

Although these are no authentic reports of typhus in Micronesia, it appears wise to consider its possible occurrence or introduction.

Since it occurs in Hawaii, the Philippine Islands, China, Japan, and New Guinea, its introduction during the movements of personnel in wartime is a definite possibility. Head lice have been reported among the natives (*12*) (*14*) (*49*). There are no records of body lice. There is also in wartime the possibility of the introduction of body lice as vectors of epidemic typhus. It appears, however, that they will not, in general, infest the natives. Rats which serve as reservoirs of endemic typhus are found throughout Micronesia. According to Kuroda (*26*), Rattus exulans Peale, Rattus rattus alexandrinus Goeffroy, Rattus rattus rattus L., and Rattus rattus frugivorous Rafinesque are common on many if not all the islands. Rattus norvegicus Berkenhout occurs only around the ports. Information on the occurrence of fleas is meager. According to Esaki (*12*), the human flea, Pulex irritans L., is extremely rare in the Japanese residences in Micronesia.

Safford (*39*) feels that the "absence of fleas" in Guam is due to the humid climate. Thompson's catalogue (*48*) does not give records for Pulex or Xenopsylla in Micronesia. Buxton's (*10*) recent paper on the distribution of fleas contains no information on Xenopsylla cheopis Rothschild, the common rat-to-man vector of endemic typhus, or on other species of rat fleas in Micronesia.

Matsumoto (*29*) states that tsutsugamushi (scrub typhus) does not occur in Micronesia, a statement substantiated by the German and Japanese reports from the Mandated Islands and the American re-

[8] Sailing Directions for the Pacific Islands, vol. 1. Hydrographic Office, U. S. Navy Department, 1938. p. 512.

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ports from Guam. Matsunaga (*30*), Iseki (*21*), and Esaki (*12*) describe a trombiculid mite whose larvae cause a troublesome "red-bug" itch in Western Micronesia. Its known range, according to Esaki, extends from the Moatrok Islands on the east, westward to and including the Palau Islands. Although the larvae of Trombicula akamushi, deliensis and perhaps others are known elsewhere as vectors of scrub typhus, Esaki states that the trombiculid larva of Micronesia is not; however, his evidence is obscure.

MALARIA

Malaria has apparently never been an autochthonous disease of Micronesia, a fact to be associated with the absence of anopheline mosquitoes. The two references in the literature to the occurrence of Anopheles, Satterlee (*40*) and Pacific Islands Pilot (in 1928 [9] but not 1938), are not based on actual collections and are probably erroneous. Fullaway (*14*), Swezey (*47*), Esaki (*12*) (*13*) as well as Schnee (*43*) and Leys (*27*) all reported the absence of Anopheles after extensive collecting.

Although numerous cases of malaria have been treated in Micronesia, especially during the German period, it is usually indicated that the disease was contracted elsewhere, frequently in Melanesia. For example, Girschner (*15*) (*18*) (*19*) (*20*), on Ponape, treated 18 cases in 1899, 12 in 1908–1909, 38 in 1909–1910, and 68 in 1910–1911. Born (*4*) recorded 4 cases from Jaluit in 1909–1910. There are numerous such records in the Japanese and German reports. Japanese Government hospitals (*54*) reported treating a few cases of malaria each year from 1924 to 1929, following which no records were released. Koch (*23*) reported that malaria is not a disease of Ponape because he was unable to find enlarged spleens or parasites in the blood of the native children. Subsequent reports in the German literature are in agreement. The Japanese reports to the League of Nations as well as the *South Sea Islands Handbook* (*52*) constantly emphasize that because of the absence of Anopheles there is no natural malaria in Micronesia. The few cases treated in Guam have definitely been imported.

The establishment of malaria in Micronesia is dependent, among other factors, on the successful introduction of Anopheles. This possibility is discussed by Mumford (*33*) (*34*) who pointed out that the larvae of Anopheles punctulatus moluccensis are adaptable to a large variety of conditions. Experience during this war has already shown that these larvae will thrive in 50 to 60 percent sea water or more. Actually the answer to the question of the possible successful establishment of anopheline mosquitoes in Micronesia is conjectural at this time. Although there are apparently suitable breeding habitats on

[9] Pacific Islands Pilot, fol. 1. Hydrographic Office, U. S. Navy Department, 1928. p. 714.

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uch islands as Guam, Saipan, Yap, Ponape, and others, unforeseen limatic or ecologic factors may prevent their survival. However, it s always imperative to be cognizant of the fact that anophelines can e accidentally but successfully transported over vast expanses of waters nd become established in new areas. The introduction of A. gambiae Giles in Brazil (*45*) is certainly adequate demonstration of this. The minimum distance between Africa and Brazil is slightly more than 1,600 miles. This was the span involved in the introduction of A. gambiae. Compare with this the distances of 600 to 1,000 miles sepa-

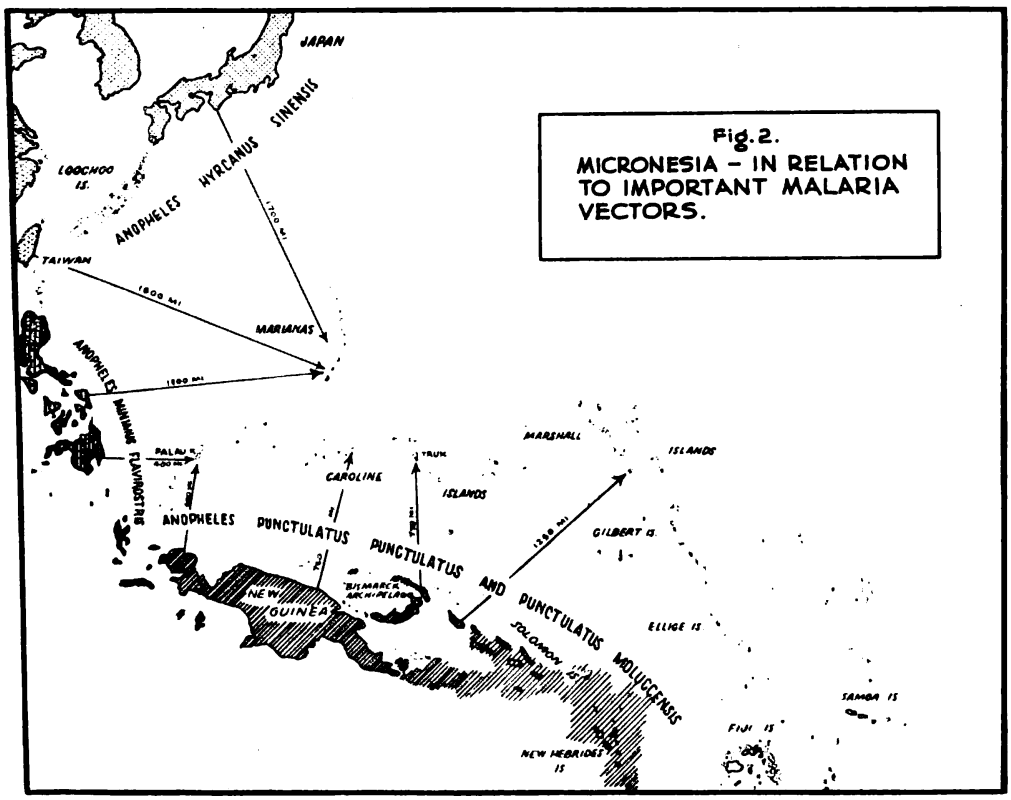


Fig. 2.
MICRONESIA – IN RELATION TO IMPORTANT MALARIA VECTORS.

rating A. punctulatus moluccensis (Swellengrebel and Swellengrebel de Graaf) of New Guinea and the Bismarck Archipelago from much of the Caroline Group, the distance of 1,700 miles separating A. hyrcanus sinensis Wiedemann of Japan and Formosa from the Marianas, and the 400 miles separating A. minimus flavirostris Ludlow of the Philippines from the Palau Group (fig. 2). A more remote possibility is A. sundaicus Rodenwaldt, a brackish water species of the Malay Archipelago. Appropriate measures should be maintained to prevent the introduction of anopheline mosquitoes. Occupation personnel must be prepared to take immediate action should these have been introduced during the Japanese occupation.

OTHER ARTHROPOD-BORNE DISEASES

Buse and Mayer (*9*) recorded three fatal cases of plague from Yap in the West Caroline Islands in 1910–1911. No further cases have been

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recorded in the literature. The *South Sea Islands Handbook* (*52*) of the Japanese Government states that plague does not occur in Micronesia. Whether or not plague can be reintroduced is dependent to a large extent on the same conditions as those which govern the possible reintroduction of typhus.

Von Prowazek (*49*) and other German physicians referred frequently to "Saipan influenza" or missilepik. Von Prowazek described it as similar and possibly identical with pappataci fever and predicted that Flebotomus would ultimately be discovered. Extensive entomologic collections in these islands have failed to detect the presence of any species in this genus and it appears extremely unlikely that missilepik is pappataci fever.

A single case of yellow fever has been reported from Micronesia in the Japanese reports to the League of Nations for 1930 (*54*). Whether or not this case is authentic cannot be ascertained. Some Japanese physicians have used "yellow fever" as a name for infectious jaundice. Since Aëdes aegypti is very numerous it is necessary to regard yellow fever as a disease which could be introduced and become widespread.

Tularemia, relapsing fever, leishmaniasis, and tick-borne encephalitis have not been reported and are assumed not to occur. With the exception of relapsing fever it appears that the vectors of these diseases are lacking. The situation in regard to the vectors of louse-borne relapsing fever is the same as that of epidemic typhus.

SUMMARY

1. Filariasis is apparently widespread in Micronesia, although the actual incidence is probably low. It has been constantly introduced from the Samoan Area and the Loochoo Archipelago. Culex quinquefasciatus, the vector of the nocturnal type, is a common mosquito throughout Micronesia; Aëdes scutellaris pseudoscutellaris, the vector of nonperiodic filariasis, is probably widespread.

2. Dengue is constantly endemic and frequently epidemic. Its vector, Aëdes aegypti, is very common.

3. There are apparently no authentic records of rickettsioses, although there is the possibility of introduction of epidemic or endemic typhus and perhaps scrub typhus.

4. Only imported cases of malaria have been recorded. Prior to the outbreak of the war, at least, anopheline mosquitoes were absent. The proximity of Melanesia in which Anopheles punctulatus moluccensis is common indicates the possibility of its introduction into Micronesia under wartime conditions.

5. Plague has been reported only once (Yap, 1910–1911).

6. A need for entomologic and epidemiologic investigations on the arthropod-borne diseases as soon after occupation as practicable is indicated.

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BLOOD PRESSURE AND OPERATIVE PROCEDURES

Exploration of the abdomen and palpation of the common bile duct are nearly always followed by a fall in blood pressure, and in some cases with weakening and temporary irregularity of the pulse. With a well-planned local and regional infiltration this is largely eliminated. Pulling on the mesenteries or parietal peritoneum to close the abdomen causes a similar fall, as also does packing the intestines into the abdomen. Manipulation of the renal pedicle affects the pressure adversely, while in a radical breast operation the pressure is continuously low, with limited response to the usual dose of pressor drug.—DODD, H.: Significance of blood-pressure readings in general surgical work; with special reference to cardiac index. Brit. M. J. 2: 811–813, December 25, 1943.

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ESSENTIAL FACTORS IN PROPER DISHWASHING

Improper dishwashing may act as an important factor in the spread of disease. This fact makes it essential that each medical officer be familiar with the factors necessary for the proper performance of this task. Regardless of the method used two principles are involved, i. e., the physical cleansing and the sterilization of mess gear.

Dishwashing machines should be so designed that a forceful stream of water will reach all surfaces of the gear when it is properly racked. The construction should be such that the washing and rinsing spray jets are readily accessible for inspection and cleaning. Both the wash water and the rinse water tanks should be equipped with thermometers so placed that the operators and inspectors can readily check upon the temperatures. The mechanical part for moving the racks through the machine should be of such design that it can be regulated to give proper exposure to wash and rinse sprays. If thermostatically controlled, the thermostat for the rinse water tank should be set for 180° F.

In the use of a dishwashing machine of proper design the following points should be observed:

1. For each 25 gallons of water in the wash water tank, 1 pound or two mess cupfulls of detergent compound should be added at the beginning of operations. In order to keep the concentration of the detergent at an efficient level, one-half of this amount should be added at the end of each 20 minutes of operation. The wash water should be changed often enough to be kept reasonably clean.
2. All mess gear should be thoroughly scraped and wherever practicable prerinsed before being put into the machine.
3. All gear should be properly racked to insure exposure of all parts to the sprays and to insure drainage.
4. The temperature of the wash water should be not less than 120° F. and not more than 140° F. Fats will not emulsify properly below 120° F. and proteins will "cook" onto the gear above 140° F.
5. The exposure time in the wash water compartment will depend upon compliance with the above factors. Ordinarily 30 to 40 seconds are required, but proper scraping and prerinsing may allow for shorter exposures. The state of cleanliness of the gear will give the final answer.
6. The temperature of the rinse spray should be not less than 180° F. An exposure time of 20 seconds is sufficient if this temperature is constantly maintained.
7. The dishes should be allowed to dry in the racks and then be stored in a clean compartment, protected from insects, dust and other contamination.

Should handwashing of gear be necessary it can be done satisfactorily by the following steps:

1. Proper scraping and prerinsing of dishes for removal of gross food particles.

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2. The use of plenty of water at a temperature between 110° and 120° F. with plenty of soap.

3. This wash water should be changed often enough to be kept reasonably clean.

4. For rinsing and sterilization the gear should be placed in racks so that collections of air will not occur, thereby preventing contact of all parts with the hot water, and be immersed in clean water with a temperature of not less than 170° F. for 2 minutes, or boiling water for ½ minute.

5. The dishes should be allowed to dry of their own heat and stored in a clean compartment, protected from insects and other contamination.

Some small naval vessels will have one-compartment dishwashing machines. In such cases sterilization and removal of detergent solution is accomplished by a steam or steam and hot water jet. The latter is preferable, and with this mixture at 200° F., an exposure of 10 seconds is considered sufficient.

In the field where each man is responsible for the cleaning and sterilization of his own gear the three-vat method should be used as follows:

1. Scraping and prerinsing or prewashing of the gear is a *must*.

2. The contents of each of the three vessels must be kept at boiling temperatures throughout the entire procedure. If oil drums are used as vats they should be mounted with the long axis horizontal, and the upper one-third or one-half of the cylindrical sides should be removed. Greater water-depth will be provided by removing only the upper one-third. Heating will be facilitated by so supporting the drums that the maximum possible area is exposed to the source of heat.

3. The first and second drums should contain adequate amounts of soap or detergent compound which should be replenished as in dishwashing machines (initial dose 1 pound per 25 gallons of water; ½ this amount at the end of each 20 minutes of dishwashing). The third drum or vat should contain clean boiling water only.

4. The contents of the vats should be changed often enough to keep them reasonably clean. It appears that it would be more practical to have adequate prewashing facilities and enough vats to care for the gear of the entire mess without actually changing contents.

5. After prewashing, each mess gear should be immersed and agitated vigorously for a few seconds in each vat.

6. Strict supervision of the entire process is necessary. The mess officer should see that an individual is made responsible for keeping the water boiling and changed as indicated. Where unit commanders are cognizant of the importance of proper dishwashing such supervision will be forthcoming.

7. The mess gear should be allowed to dry of its own heat and stored in as sanitary a manner as possible.

8. In all cases, except where the medical officer directs otherwise, the mess gear should be resterilized immediately before use.

Chemical sterilization of dishes may be resorted to when the use of heat is impractical. In order that a chemical agent may be effective the dishes must be thoroughly clean and free of organic matter, and must have an exposure time of at least two minutes to a solution of proper concentration. It would appear that its use is

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limited to situations where the scullery crew handles the procedure. Ordinary grade A calcium hypochlorite as used for purification of water is suitable for this purpose. One-half ounce of this put into 25 gallons of lukewarm clean water will result in a solution with a chlorine residual of about 100 parts per million. It rapidly loses its strength and should not be used when its chlorine residual is below 50 parts per million. One "batch" made, as above described, will probably care for the mess gear of 200 men at any one meal. The gear may be rinsed with clean water after this, if desired.

If an ortho-tolidine solution is available, a simple test may be used to determine if the chlorine residual is equal to 50 parts per million. The ortho-tolidine solution is made as follows: One gram (actual weight) of ortho-tolidine is put into a mortar, to which is added 5 cc. of 20 percent hydrochloric acid (prepared by adding 1 part of concentrated hydrochloric acid, sp. gr. 1.18–1.19, to 4 parts of distilled water). Grind to a thin paste and add 150 to 200 cc. of distilled water. Transfer to a 1,000-cc. graduate and add enough distilled water to bring the volume up to 505 cc. Then add 20 percent hydrochloric acid to make a total volume of 1,000 cc. Store in amber bottles and do not keep for longer than 6 months.

The equipment necessary to test a solution for a chlorine residual of not less than 50 parts per million is the solution above, a test tube etched at the 2-cc. level and the 5-cc. level, and a medicine dropper. The medicine dropper should be of such size that the number of drops required to deliver 2 cc. would be between 30 and 50.

The test: After thoroughly washing the test tube and the medicine dropper with clean water, fill the test tube to the 2-cc. level with the solution to be tested, avoiding any floating particles. With clean nonchlorinated water fill to the 5-cc. level, using the dropper for this latter. Then add one drop of ortho-tolidine solution. Hold the upper part of the tube firmly and tap the lower end sharply 50 times with the fingers of the other hand. The presence of chlorine in a concentration equivalent to at least 50 parts per million is indicated by the separation out of brownish particles within 5 minutes. Chloramine solutions of equivalent strength are indicated by the solution becoming cloudy within 5 minutes.

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STATISTICS

HEALTH OF THE NAVY

The statistics (annual rates per 1,000 average strength) appearing in this summary were compiled from data contained in monthly reports of communicable diseases received in the Bureau of Medicine and Surgery for the months of October, November, and December, 1938–1943:

ENTIRE NAVY

Year	All causes	All diseases	Injuries and poisonings	Communicable diseases		Venereal diseases
				A	B	
1938	382	325	57	4	76	81
1939	417	363	54	3	84	98
1940	560	511	49	35	223	81
1941	391	332	59	13	100	45
1942	461	412	49	24	187	31
1943	530	480	50	42	203	28

FORCES ASHORE

1938	386	330	55	7	104	40
1939	422	368	54	4	117	52
1940	536	487	49	27	229	52
1941	424	366	58	18	126	30
1942	510	466	45	30	227	25
1943	568	520	48	51	232	25

FORCES AFLOAT

1938	380	321	59	2	59	103
1939	414	360	54	3	64	126
1940	581	533	48	43	219	106
1941	354	294	60	7	72	62
1942	338	279	59	9	86	45
1943	393	335	58	9	101	39

DISABILITIES OR DISEASES CAUSING SEPARATION FROM THE SERVICE

The following table was prepared from reports of medical surveys received in the Bureau during September, October, November, and

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December 1943, in which disabilities or diseases causing separation from the service existed prior to entry into the Navy:

Cause	Number of medical surveys	Cause	Number of medical surveys
Abscess, lung	3	Angina pectoris	10
Abscess, psoas, left	1	Ankylosis	16
Abscess, seminal vesicle	1	Anomaly, congenital, 1st sacral segment	1
Absence, acquired, carpal scaphoid	1	Anomaly, congenital, lumbar vertebrae	1
Absence, acquired, coccyx	1	Aortitis	1
Absence, acquired, distal interphlangeal joints, 3rd and 4th rt. fingers	1	Aphakia	2
Absence, acquired, lung	1	Arachnoiditis	1
Absence, acquired, spleen	1	Arteriosclerosis, cerebral	2
Absence, acquired, teeth	1	Arteriosclerosis, general	25
Absence, acquired, 5th metatarsal	1	Arteriosclerosis, local	2
Absence, congenital, eye	1	Arthritis, acute	5
Absence, congenital, kidney	1	Arthritis, chronic	652
Absence, congenital, middle phalanges, rt. hand	1	Arthritis deformans	11
Accessory ribs	5	Asthma	693
Achylia gastrica	1	Astigmatism, compound hyperopic	39
Acne conglobata	1	Astigmatism, compound myopic	31
Acne, cystic, face	1	Astigmatism, mixed	33
Acne, pustular	3	Astigmatism, simple hyperopic	9
Acne, trunk and upper extremity	1	Astigmatism, simple myopic	11
Acne vulgaris	8	Ataxia, hereditary	1
Acrocyanosis	2	Atony, anal sphincter	1
Acromegalia	1	Atony, gallbladder	1
Adenoma, thyroid gland	1	Atony, left knee and leg	1
Adhesions, abdominal	8	Atresia, acquired, rectum and descending colon	1
Adhesions, intra-abdominal	1	Atrophy, facial, bilateral	1
Adhesions, peritoneal	1	Atrophy, lower extremity	14
Adiposis dolorosa	1	Atrophy, optic nerve	7
Albuminuria	34	Atrophy, spine	1
Alcoholism, chronic	7	Atrophy, testicle	1
Allergy, asthmatic bronchitis	1	Atrophy, upper extremity	13
Allergy, chronic	2	Blepharitis	1
Allergy, cold	5	Bromidrosis	1
Allergy, gastro-intestinal	2	Bronchiectasis	54
Allergy, laryngeal	1	Bronchitis, chronic	43
Allergy, multiple	2	Burn, elbow	1
Allergy, nasal	12	Burn, foot, x-ray	1
Allergy, pruritus	1	Bursitis, acute	1
Allergy, skin	5	Bursitis, chronic	16
Amblyopia	205	Calculus, kidney	10
Amblyopia ex anopsia	36	Calculus, lungs	2
Amenorrhea	2	Calculus, prostate	13
Amputation, traumatic	3	Calculus, renal	11
Anemia, pernicious	1	Calculus, salivary gland	1
Anemia, secondary	1	Calculus, ureter	2
Anemia, sickle cell	2	Callosity	4
Anemia, splenic	1	Calcinosis interstitialis	1
Aneurysm, arteriovenous, temporal artery	1	Cardiac arrhythmia, auricular fibrillation	5
Aneurysm, heart	1	Cardiac arrhythmia, heart block	1
Aneurysm, nasal plexus	1	Cardiac arrhythmia, paroxysmal tachycardia	15
Angioneurotic edema	4		

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Cause	Number of medical surveys
Cardiac arrhythmia, premature contractions	4
Cardiac arrhythmia, sinus arrhythmia	2
Cardiac disorder, functional	7
Cardiospasm	4
Caries, teeth	2
Carotid sinus syndrome	1
Cataract	36
Cataract, bilateral	3
Cataract, congenital	3
Cataract, incipient	1
Cataract, traumatic	1
Cellulitis	1
Cerebrospinal syphilis, undifferentiated	7
Cerebral syndrome (post-traumatic)	2
Cervicitis, chronic	1
Cheilitis glandularis apostematosa	1
Cholangitis	1
Cholecystitis	10
Cholelithiasis	7
Chondroma	1
Chorea, chronic	7
Chorioretinitis	37
Choroiditis	19
Cicatrix, skin	14
Cirrhosis, liver, atrophic	4
Cirrhosis, liver, hypertrophic	2
Claustrophobia	2
Colitis, chronic	7
Colitis, ulcerative	4
Colloid degeneration, retina	1
Coloboma of iris	2
Colon, incomplete rotation, congenital	1
Color blindness	2
Compression, dorsal vertebrae	1
Concussion syndrome, post-traumatic	1
Conjunctivitis, catarrhal	2
Conjunctivitis, chronic	1
Conjunctivitis, vernal	1
Constitutional psychopathic inferiority without psychosis	94
Constitutional psychopathic state, emotional instability	561
Constitutional psychopathic state, inadequate personality	431
Constitutional psychopathic state, pathological liar	10
Constitutional psychopathic state, paranoid personality	28
Constitutional psychopathic state, schizoid personality	225
Constitutional psychopathic state, sexual psychopathy	24
Contracture	9
Contusion, encephalopathy, post-traumatic	1
Contusion, sternum	1
Convulsion, postencephalitic	1
Coronary heart disease, arteriosclerotic	25
Coxa vara	2
Cryptorchidism	41
Curvature, spine	37
Cyclitis	1
Cyclothymic personality	1
Cyst, arachnoid, lumbar	1
Cyst, Baker's	2
Cyst, bone	2
Cyst, branchial	3
Cyst, lung	2
Cyst, ovarian	3
Cyst, retention, thyroglossal duct	1
Cyst, semilunar cartilage	2
Cyst, synovial, rt. knee	1
Cyst, tubo-ovarian	1
Cystitis, acute	1
Cystitis, chronic	6
Cystocele	1
Dacryocystitis	3
Deafness, bilateral	209
Deafness, unilateral	86
Defective physical development	7
Deformity, acquired	373
Deformity, congenital	256
Dementia paralytica	7
Dementia praecox	386
Dementia pugilistica	2
Depression, reactive	4
Dermatitis, allergic	1
Dermatitis, atopic	12
Dermatitis, contact (cause unknown)	1
Dermatitis, eczematoid	2
Dermatitis herpetiformis	2
Dermatitis, neurologic	1
Dermatitis seborrheica	2
Dermatitis, varicose	1
Dermatitis venenata	3
Dermatitis, verruca	1
Dermatitis, x-ray, effects of	1
Detachment, choroid	1
Detachment, retina	3
Deviation, nasal septum	1
Diabetes insipidus	2
Diabetes mellitus	44
Diarrhea, chronic	1
Dilatation, cardiac, chronic	1
Diplopia	1
Dislocation, acromioclavicular	1
Dislocation, articular cartilage	54
Dislocation, chronic, recurrent	54
Dislocation, elbow	1

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Cause	Number of medical surveys
Dislocation, lens, rt. eye	1
Dislocation, sternoclavicular	2
Dislocation, vertebrae	6
Displacement, uterus	5
Displacement, ovary	1
Diverticulum, duodenum	4
Diverticulum, urinary bladder	2
Diverticulitis, intestinal	1
Drug addiction, barbiturates	1
Drug addiction, mariahuana	1
Duodenitis	10
Dysinsulinism	10
Dysmenorrhea	3
Dysphonia	1
Dyspituitarism	1
Dystrophy, muscular, progressive	5
Eczema	39
Effort syndrome	33
Elephantiasis, nonfilarial	2
Emphysema, pulmonary	4
Encephalitis, chronic	13
Encephalopathy, post-traumatic	13
Endarteritis, both legs	2
Endocarditis, chronic	3
Endocrinopathy, gonad, pituitary	1
Endocrinopathy, pituitary basophilism	1
Endocrinopathy, ovarian dysfunction	1
Endocrinopathy, testicular	1
Endocrinopathy, type unknown	1
Enlarged prostate	2
Enteritis, chronic	1
Enterocolitis, chronic	1
Enuresis	305
Epididymitis, chronic, nonvenereal	17
Epidermolysis bullosa	6
Epilepsy	518
Epilepsy, Jacksonian	1
Epiphysitis, humerus	1
Epiphysitis, spine	15
Epiphysitis, vertebrae	5
Epistaxis	1
Epithelioma, cheek	1
Epithelioma, lip	2
Erythema multiforme	1
Erythema nodosum	1
Erythromelalgia	1
Exophthalmos	1
Favus	1
Fever, cause undetermined	1
Fibroadenoma	3
Fibrosis, pulmonary, chronic	1
Fibrositis, chronic, spine	1
Fibrositis, chronic	1
Filariasis, legs	1
Fistula, branchial	2
Fistula in ano	4
Fistula, neck	1
Fistula, urethral	6
Flat foot	447
Foreign body, nontraumatic	2
Foreign body, traumatic	11
Fracture, compound	4
Fracture, simple	31
Frostbite	2
Furuncle, multiple	1
Fungus infection, skin	5
Ganglion, tendon sheath, popliteal	1
Gastritis, chronic	74
Gastroduodenitis	3
Gastro-enteritis, chronic	3
Gaucher's disease	1
Genu recurvatum	3
Genu valgum	2
Genu varum	1
Glaucoma	8
Glioma	2
Glycosuria	12
Goiter, adenomatous	2
Goiter, edematous	1
Goiter, exophthalmic	3
Goiter, simple	1
Gonococcus infection, Bartholin's gland	1
Gonococcus infection, epididymis	3
Gonococcus infection, joint	1
Gonococcus infection, prostate	159
Gonococcus infection, urethra	1
Gout, chronic	3
Hallux valgus	13
Hammertoe	11
Hay fever	23
Headache	62
Heart disease, congenital	27
Hemangioma	5
Hematoma, traumatic	1
Hematuria	1
Hemianopsia	2
Hemophilia	4
Hemoptysis	2
Hemorrhage	2
Hemorrhage, retina	1
Hepatitis, chronic	2
Hernia, diaphragmatic	2
Hernia, epigastric	2
Hernia, femoral	1
Hernia, inguinal, bilateral	1
Hernia, inguinal, direct	1
Hernia, inguinal, indirect	70
Hernia, intervertebral disc	12
Hernia, muscle	5
Hernia, recurrent, after operation	12
Hernia, umbilical	1

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Cause	Number of medical surveys
Hernia, ventral	6
Herniation, nucleus pulposus	3
Hodgkin's disease	3
Hookworm disease	2
Hydrocephalus	1
Hydronephrosis	21
Hyperchlorhydria	2
Hyperhidrosis	3
Hyperopia	12
Hypertension, arterial	253
Hypertensive heart disease	16
Hyperthyroidism	18
Hypertrophy, bone	1
Hypertrophy, heart	6
Hypertrophy, ligamenta flava	1
Hypertrophy, masseter muscle	1
Hypochlorhydria	1
Hypochondriasis	17
Hypopituitarism	1
Hypoplastic kidney	1
Hypotension, arterial	1
Hypothyroidism	2
Ichthyosis	2
Ileitis, regional	2
Incontinence, urine	5
Insufficiency, ocular muscle	4
Intellectual inadequacy	1
Intention tremor	1
Intermittent speech block	1
Intracranial injury	102
Intraspinal injury	1
Iridocyclitis	3
Iridodialysis	1
Iritis	3
Irritable colon	14
Jaundice, hemolytic, acquired	1
Joint, internal derangement of	156
Keloid	1
Keratitis	6
Keratoconus	5
Keratoderma	1
Kerato-iritis	1
Keratosis, follicularis	1
Keratosis	3
Leukoplakia, buccal	1
Loose body in joint	19
Loss of substance of bone	3
Lupus erythematosis	2
Lymphadenitis	4
Lymphadenopathy	1
Lymphangiectasis	1
Lymphangitis	3
Lymphedema	3
Lymphogranuloma venereum	3
Lymphosarcoma	3
Macular degeneration, eye	7
Malaria	6
Malnutrition	1
Malocclusion, teeth	3
Mastoiditis, chronic	89
Melancholia, involutional	1
Melanoma	1
Meniere's disease	4
Meningocele, sacrococcygeal	1
Menopause	1
Mental deficiency (moron)	127
Mental deficiency (imbecile)	1
Metatarsalgia	21
Metrorrhagia	1
Migraine	89
Myelodysplasia with spina bifida	1
Myocarditis, chronic	27
Myoma of uterus	3
Myopia	44
Myopic degeneration	1
Myositis, acute	1
Myositis, chronic	122
Myositis, progressive, ossifying	2
Myotonia, atrophic	1
Narcolepsy	15
Necrosis, aseptic	1
Necrosis, carpal scaphoid	1
Nephritis, chronic	39
Nephroptosis	3
Neuralgia	5
Neuritis	56
Neurodermatitis	2
Neurofibromatosis	3
Neuroma, median nerve	1
Neuroma, ulnar nerve	1
Neurogenic dysfunction, left ureter	1
Neurosis, cardiac	9
Neurosis, gastric	67
Neurosis, intestinal	52
Neurosyphilis, serological	6
Night blindness	4
Nostalgia	1
Nystagmus	2
Obesity	6
Obstruction, intestinal	7
Opacity, cornea	13
Opacity, vitreous humor	4
Orchitis, chronic	1
Osgood-Schlatter disease	17
Osteitis fibrosa cystica	1
Osteoarthropathy, hypertrophic	8
Osteochondritis deformans	28
Osteochondritis dissecans	37
Osteochondroma, femur	3
Osteochondroma, fibula	1
Osteochondroma, ilium	1
Osteochondroma, multiple	1
Osteochondroma, tibia	5
Osteochondromatosis	7
Osteoma	6
Osteomyelitis, chronic	21
Osteopetrosis	1
Otitis media, chronic	435
Otosclerosis	9

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Cause	Number of medical surveys
Ozena	7
Pachymeningitis, cerebral, old	1
Pansinusitis	32
Papilloma, bilateral	1
Papilloma, urinary bladder	1
Paralysis agitans	3
Paralysis, Brown-Sequard's	1
Paralysis, brachial plexus	2
Paralysis, left rectus muscle	1
Paralysis, nerve	22
Paralysis, ocular muscle	4
Paralysis, vocal cords	2
Paranoia	1
Paranoid state	5
Paraplegia, ataxic	1
Parotitis	1
Perforated ear drum	23
Perforated nasal septum	3
Pericarditis, chronic	1
Periostitis, chronic	6
Periostitis, traumatic	2
Personality disorder, post-traumatic	10
Pes cavus	50
Phlebitis	31
Pleurisy, fibrinous	27
Pleurisy, serofibrinous	2
Pneumothorax, spontaneous	1
Pneumonitis, chronic, nontuberculous	1
Poikiloderma atrophicans vasculare	1
Poliomyelitis, anterior, acute	6
Polycystic disease, kidney	1
Polydactylism, hands and feet	1
Polyposis, multiple, colon	1
Polypus, duodenum	2
Polypus, nasal	13
Postconcussion syndrome	3
Prolapse, rectum	4
Prostatitis, chronic, nonvenereal	12
Protruded intervertebral disc	1
Pruritus ani	1
Pruritus, face and body	1
Pseudohypertrophic muscular dystrophy	1
Psoriasis	23
Psychoneurosis, anxiety neurosis	522
Psychoneurosis, compulsion neurosis	28
Psychoneurosis, conversion hysteria	1
Psychoneurosis, epileptic	1
Psychoneurosis, hysteria	279
Psychoneurosis, mixed	324
Psychoneurosis, neurasthenia	153
Psychoneurosis, occupational	1
Psychoneurosis, psychasthenia	15
Psychoneurosis, situational	38
Psychoneurosis, traumatic	33
Psychoneurosis, unclassified	252
Psychoneurosis, war neurosis	1
Psychoneurotic personality	1
Psychosis, epileptic	5
Psychosis, intoxication, alcoholic	2
Psychosis, manic depressive	92
Psychosis, traumatic	1
Psychosis, unclassified	56
Psychosis with organic brain disease	2
Psychosis with other disabilities (mental deficiency)	12
Pterygium	6
Ptosis	1
Purpura hemorrhagica	1
Purpura rheumatica	1
Pustular bacteride	1
Pyelitis, chronic	1
Pyelonephritis	7
Pylorospasm	10
Raynaud's disease	6
Recklinghausen's disease	1
Relaxation, ligaments, knee	1
Retinitis	31
Rheumatic fever	131
Rheumatism, muscular	18
Rhinitis, atrophic	14
Rhinitis, hypertrophic	2
Rupture, cruciate ligaments	1
Rupture, intervertebral disc	1
Rupture, nontraumatic	3
Rupture, traumatic	31
Salpingitis	27
Sarcoma, melanotic	1
Schizoid personality	9
Schizophrenic-like reaction type, acute	1
Sclerosis, disseminated	9
Sclerosis, lateral	1
Seasickness	14
Sexual perversion	7
Silicosis	5
Simple adult maladjustment	27
Sinus, inguinal	1
Sinus, urethral	1
Sinusitis, chronic	1
Sinusitis, ethmoidal	7
Sinusitis, frontal	7
Sinusitis, maxillary	28
Somnambulism	80
Spastic paraplegia	1
Splanchnoptosis	1
Spondylitis	19
Spondylolisthesis	33
Sprain, joint	38
Spur, bone	9
Strabismus	25
Stammering	11
Stenosis, bronchus	2
Stenosis, nasal duct	1

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Cause	Number of medical surveys
Stenosis, pylorus	1
Strain, muscular	8
Strain, sacro-iliac	1
Stricture, esophagus	2
Stricture, intestine	1
Stricture, urethra	23
Stuttering	8
Sycosis vulgaris	2
Syncope	28
Syndrome, post-traumatic	5
Synechia	1
Synovitis, chronic	26
Synovitis, traumatic	2
Syphilis	321
Syphilis, seropositive only	10
Syringomyelia	2
Tabes dorsalis	1
Tachycardia	22
Talipes	12
Tenosynovitis, chronic	3
Teratoma	2
Tetany	1
Thrombo-angiitis obliterans	9
Thrombophlebitis	1
Thrombosis, cerebral	1
Thrombosis, femoral veins	1
Thrombosis, popliteal	1
Thrombosis, saphenous vein	1
Thrombosis, subclavian vein	1
Thyroiditis, chronic	1
Torsion, traumatic	1
Torticollis, spasmodic	1
Tracheobronchitis, chronic	2
Trachoma	8
Tremor, familial	1
Tuberculosis, bone	2
Tuberculosis, cervical lymph glands	3
Tuberculosis, dorsal vertebrae	1
Tuberculosis, general miliary	1
Tuberculosis, kidney	2
Tuberculosis, kidney and bladder	1
Tuberculosis, peritoneal	1
Tuberculosis, primary, healed	21
Tuberculosis, pulmonary, chronic, active	49
Tuberculosis, pulmonary, acute pneumonic	1
Tuberculosis, pulmonary, chronic, arrested	168
Tuberculosis, testicle	1
Tuberculosis, tracheobronchial	1
Tumor, brain	1
Tumor, breast	1
Tumor, calcified, intra-abdominal	1
Tumor, epithelial cell, skull	1
Tumor, mixed, activity unknown	7
Tumor, mixed, benign	2
Tumor, uterus	2
Tumor, lung	2
Typhoid fever carrier	1
Ulcer, colon	1
Ulcer, cornea	1
Ulcer, duodenum	557
Ulcer, duodenum, perforated	1
Ulcer, gastric	3
Ulcer, jejunum	1
Ulcer, penis	1
Ulcer, peptic	3
Ulcer, skin	2
Ulcer, stomach	28
Ulcer, varicose	2
Undulant fever	1
Union of fracture, faulty	102
Ureteral colic	1
Urticaria	11
Valvular heart disease, aortic and mitral	60
Valvular heart disease, aortic insufficiency	59
Valvular heart disease, aortic stenosis	25
Valvular heart disease, mitral insufficiency	148
Valvular heart disease, mitral stenosis	94
Valvular heart disease, pulmonic	5
Varicose veins	48
Varicocele	1
Vertigo	2
Vitiligo	1
Vomiting	1
Wart, plantar	3
Wound, gunshot	2
Wound, lacerated	2
Total	14,395

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ORAL BISMUTHATE IN SYPHILIS

Dihydroxypropyl bismuthate, a new bismuth compound, was given a clinical trial in the treatment of syphilis. The drug is given orally on an empty stomach in a dose of 50 to 100 mg., calcu-

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lated as bismuth, three times a day. The present recommended dose is 300 mg. a day. With the exception of one case of nonspecific dermatitis, no untoward reactions occurred.

When dihydroxypropyl bismuthate is given orally in the recommended dose, bismuth is excreted in the urine in much larger quantities than those amounts mentioned in the literature as being indicative of satisfactory treatment. Blood concentrations of bismuth following oral administration of dihydroxypropyl bismuthate averaged higher than those that follow the standard amount of bismuth subsalicylate injected intramuscularly. The bismuth concentration in the spinal fluid following oral ingestion of dihydroxypropyl bismuthate rises immediately to levels much higher than those obtained with bismuth subsalicylate intramuscularly.

Dihydroxypropyl bismuthate orally causes the disappearance of syphilitic lesions nearly as rapidly as bismuth by intramuscular injection. Spirochetes disappeared from dark-field positive secondary lesions with similar rapidity.—NOMLAND, R.; WHEELER, L. M.; CARNEY, R. G.; KUEVER, F. A.; and GROSS, E. G.: Dihydroxypropyl bismuthate orally in treatment of syphilis; clinical and chemical study (preliminary report). Am. J. Syph., Gonor. & Ven. Dis. 28: 68-78, January 1944.

CARDIAC INDEX

The cardiac index is estimated as follows: The normal systolic blood pressure is 120 mm. Hg. and diastolic 80 mm. Hg., the difference—the pulse pressure—being 40 mm. The cardiac index is reckoned by working out the percentage fraction which results by placing the pulse pressure as numerator over the diastolic pressure as denominator. Ordinarily the pulse pressure is 40 and the diastolic pressure 80, giving a fraction of $^{40}/_{80}$=50 percent.—DODD, H.: Significance of blood-pressure readings in general surgical work; with special reference to cardiac index. Brit. M. J. 2: 811–813, December 25, 1943.

SULFONAMIDE EFFECT ON BLOOD OXYGEN

Single therapeutic doses of the sulfonamide drugs (sulfanilamide, sodium sulfapyridine, sulfathiazole, sodium sulfadiazine, and sulfaguanidine) produced small, but physiologically insignificant quantities of methemoglobin or sulfhemoglobin in the blood of dogs.

Administration of single doses of these various sulfonamides resulted in a slight reduction in the blood oxygen capacity, although individual responses varied. The mean percent reduction ranged from 4.1 percent with sodium sulfadiazine to 9.5 percent with sulfaguanidine.—HALL, J. F., JR.: Effect of sulfonamides on blood oxygen and carbon dioxide capacity, arterial saturation, and blood pigments. Am. J. Physiol. 140: 483–489, January 1, 1944.

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NOTES ON OUR RESERVE CONTRIBUTORS

Allan, John H., Lieutenant (MC) USNR (*Fractures of Transverse Processes of Lumbar Vertebrae*, p. 780). A. B., Johns Hopkins University, 1929; M. D., Johns Hopkins University School of Medicine, 1933. Resident, New York Orthopedic Hospital, 1937–39; instructor in orthopedic surgery, Yale University School of Medicine, 1939–40; staff member: Pennsylvania Hospital, Children's Hospital of Philadelphia, Graduate Hospital of the University of Pennsylvania, Women's Medical College of Pennsylvania, 1940–. Diplomate American Board of Orthopedic Surgery, 1942. Member Philadelphia County Medical Society and Pennsylvania State Medical Society.

Barber, Philip S., Lieutenant Commander (MC) USNR (*Pilonidal Cyst*, p. 930). A. B., University of California, 1926; M. D., University of California Medical School, 1930. Intern, Dept. of Surgery, University of California Hospital, 1929–30; private practice, 10 years, Porterville, Calif.; City Health Officer, Porterville, Calif., 9 years. Member California Medical Association; Tulare County Medical Society.

Bradford, F. Keith, Lieutenant Commander (MC) USNR (*Intervertebral Disc Problem in the Navy*, p. 763). M. D., Medical College of Virginia, 1933. Intern, State of Wisconsin General Hospital, Madison, Wis., 1933–34; Douglas Smith fellow in neurology, 1934–35; resident in neurology, 1935–36, and resident in neurological surgery, 1936–37, Chicago University Clinics, Chicago, Ill.; instructor, surgery, Louisville University, 1937–39. Certified 1940. Active staff member, neurological surgery: Memorial Hospital, St. Joseph's Infirmary; assistant, neurological surgery, Jefferson Davis Hospital; instructor, surgery, Texas University. Member American Academy of Neurological Surgery; American Medical Association; Harvey Cushing Society.

Candel, Samuel, Lieutenant Commander (MC) USNR (*Mumps Meningitis*, p. 861). B. S., College of the City of New York, 1925; M. A., Columbia University, 1926. M. D., Jefferson Medical College, 1930. Intern: Jewish Hospital, 1930–32; Kingston Avenue Hospital, 1932. Assistant, medicine, Jewish Hospital; clinical assistant, medicine, Metropolitan Hospital, Welfare Island; clinical assistant, medicine and cardiology, New York Medical College and Flower Hospital. Member American Association of the History of Medicine; American Medical Association; American Heart Association; associate American College of Physicians; diplomate American Board of Internal Medicine, 1939.

Consolazio, William V., Lieutenant H-V (S) USNR (*A Tablet Emergency Ration for Lifeboats and Rafts*, p. 841). B. S., Tufts College, 1933; Harvard Graduate School of Chemistry, 1934–35. Research associate, Fatigue Laboratory, Harvard University, 1934; research biochemist, Massachusetts General Hospital, 1937–41. Member American Chemical Society; American Association for the Advancement of Science; Society of Experimental Biology and Medicine.

Cuono, Joseph D., Lieutenant (MC) USNR (*Prevention of Chronic Empyema*, p. 879). B. S., New York University, 1932; M. D., New York Medical School, 1936. Intern, Paterson St. Joseph's Hospital, 1936–38; private practice, Pater-

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son, N. J., July 1938–Jan. 1940; assistant resident, surgery, Jan. 1940–July 1940, and resident, thoracic surgery, July 1940–July 1942, Sea View Hospital; assistant visiting thoracic surgeon, Metropolitan Hospital, New York City. Member Bergen County Medical Society, N. J.

Czwalinski, Peter F., Commander (MC) USNR (*Burn Treatment at Sea*, p. 838). M. D., Northwestern University Medical School, 1929. Intern, 1928–29, and senior lecturer, 1931–38, St. Mary of Nazareth Hospital, Chicago, Ill.; associate professor, surgical technic, Cook County Post-Graduate School, 1934–36; associate clinical professor of surgery, Loyola University Medical School, Chicago, 1932–37; associate attending surgeon, Cook County Hospital, Chicago, 1931–37; member senior surgical staff, St. Mary of Nazareth Hospital, 1938–41. Member American Medical Association; Chicago Medical Society; Illinois Medical Society; Polish Medical and Dental Association of America (president 1940 and 1942).

Director, William, Lieutenant Commander (MC) USNR (*Generalized Vaccinia and Vaccinial Reaction*, p. 884). M. D., New York University and Bellevue Hospital Medical College, 1927. Intern: Coney Island Hospital, Brooklyn, 1927; Middlesex General Hospital, New Brunswick, N. J., 1927–28; Kingston Avenue Hospital, Brooklyn, 1928 (2 months); Montefiore Hospital for Chronic Disease, 1928–29. Certified 1935. Assistant chief, dermatology and syphilology, New York University Clinic; assistant visiting dermatologist and syphilologist, Bellevue Hospital; assistant clinical professor, dermatology and syphilology, New York University College of Medicine. Member American Academy of Dermatology and Syphilology; American Medical Association.

Farner, Donald S., Ensign H–V(S) USNR (*Arthropod-Borne Diseases in Micronesia*, p. 977). B. S., Hamline University, 1937; M. A., 1939, Ph. D., 1941, University of Wisconsin. Assistant in zoology, 1937–41, instructor in zoology, 1941–, University of Wisconsin; temporary naturalist and aquatic biologist, National Park Service, 1939–41; biologist, Kraft Waste Disposal Committee, 1942–43. Member American Association for the Advancement of Science; Wisconsin Academy of Science, American Society of Zoologists; American Ornithologists' Union.

Fearon, Henry D., Lieutenant Commander (MC) USNR (*Adaptation of the Westergren Method of Sedimentation Test*, p. 947). M. D., Syracuse University Medical School, 1927. Intern, Methodist Hospital, 1927–29; resident in medicine, University Hospital, Syracuse, 1929–30; chief of Cardiac Clinic, Methodist Hospital, 1934–; visiting physician, Brooklyn Cancer Institute, 1938–; assistant physician, Kingston Avenue Hospital, tuberculosis service, 1935–38; private practice, Brooklyn, N. Y., 1930–. Fellow American College of Physicians; member American Medical Association; New York State and Kings County medical societies; American Heart Association; diplomate American Board of Internal Medicine.

Field, Charles H., Lieutenant (MC) USNR (*An Instrument for Adult Circumcision*, p. 950). M. D., University of Georgia School of Medicine, 1941. Intern, Vanderbilt University Hospital, Nashville, Tenn.

Fox, Frank E., Lieutenant (MC) USNR (*Skin Pigmentation Following Sulfonamide Therapy*, p. 923). A. B., Syracuse University, 1926; M. D., Syracuse University College of Medicine, 1930. Intern, Holy Name Hospital, 1929–30; private practice, New York State, 1930–42; staff member, Lee Memorial Hospital, Fulton, N. Y.; city health officer, 1932–34–42. Member Oswego County and New York State medical societies; American Academy of Dermatology

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Futcher, Palmer H., Lieutenant (MC) USNR (*A Tablet Emergency Ration for Lifeboats and Rafts*, p. 841). A. B., Harvard University, 1932; M. D., Johns Hopkins University Medical School, 1936. House officer on Medical Service of Johns Hopkins Hospital, 1936–39. Assistant resident physician at Hospital of the Rockefeller Institute, 1939–41.

Ganz, Robert N., Lieutenant Commander (MC) USNR (*Adaptation of the Westergren Method of Sedimentation Test*, p. 947). A. B., Harvard College, 1920; M. D., Harvard Medical School, 1924. Intern, Massachusetts General Hospital, 1925; private practice, 1927–; intern, medical service, 1925–27, associate physician, 1927–36, and staff member, 1936–, Children's Hospital, Boston; assistant in pediatrics, Harvard Medical School, 1927–36. Member American Medical Association; American Academy of Pediatrics; Massachusetts Medical Society.

Gerrard, Elizabeth J., Ensign W–V(S) (H) USNR (*A Tablet Emergency Ration for Lifeboats and Rafts*, p. 841). Stanford University, 1937–39; laboratory technician in research, Abbott Foundation for Medical Research, Passavant Hospital, Chicago, Ill., 1940–42.

Godfrey, Ellwood W., Lieutenant (MC) USNR (*Eye Casualties Treated on a Hospital Ship*, p. 802). M. D., University of Pennsylvania Medical School, 1937. Intern, Bryn Mawr Hospital, 1938; fellow in radiology, radiology department, University of Pennsylvania Hospital, 1938–41. Associate instructor in radiology, Graduate School of Medicine, University of Pennsylvania, 1938–41; associate instructor in radiology, University of Pennsylvania, 1938–41; instructor, 1941. Diplomate American Board of Radiology, 1941; member American Medical Association; American College of Radiology; Radiologic Society of North America.

Goodall, Robert E., Lieutenant (DC) USNR (*Evaluation of Ammoniacal Silver Nitrate*, p. 897). D. D. S., Atlanta-Southern Dental College, 1939. Private practice since 1939. Member Alabama Dental Association; American Dental Association.

Hack, Rudolf W., Lieutenant (MC) USNR (*Gunshot Wound of the Abdomen*, p. 928). A. B., University of Illincis, 1931; B. S. and M. D., University of Illinois College of Medicine, 1935. Intern: Kankakee State Hospital, Kankakee, Ill., June 1935–Jan. 1936; Cook County Hospital, Chicago, Ill., Jan. 1936–July 1937; resident in surgical obstetrics, Cook County Hospital, July 1937–July 1938; general practitioner, Corner Brook, Newfoundland, Aug. 1938–July 1940; assistant surgeon, Corner Brook General Hospital; surgical resident, Henrotin Hospital, Chicago, July 1940–Jan. 1941. Private practice, Raton, New Mexico, March 1941. Fellow American Medical Association.

Hamlin, Hannibal, Lieutenant Commander (MC) USNR (*Experience with Brain Injuries in the Pacific*, p. 822). M. D., Yale University School of Medicine, 1936. Intern, Bellevue Hospital, New York City, 1936–38; assistant, neuropathology, Yale University, 1938–39; resident, neurology, Bellevue Hospital, 1939–40; assistant, neurosurgery, Boston City Hospital; Massachusetts General Hospital, 1940–41; resident, neurosurgery, Children's Hospital, Boston, 1941–42. Fellow American Museum of Natural History; American Society of Physical Anthropologists.

Harms, Herman P., Lieutenant (MC) USNR (*Gunshot Wound of the Abdomen*, p. 928). B. A., Hope College, 1929; M. D., University of Chicago Medical School, 1933. Intern and resident, University of Chicago Clinic, Dept. of Surgery, 1933–36; private practice, Holland, Mich., 1936–42. Chief of staff, Holland

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City Hospital, 1941–. Member American Medical Association; Michigan State Medical Society; fellow American College of Surgeons.

Hicks, Robert A., Lieutenant Commander (MC) USNR (*Safe Universal Blood*, p. 852). B. S., University of Michigan, 1926; M. D., 1930. Teaching assistant, University of Michigan, 1925–29; intern, Institute of Pathology, Western Pennsylvania Hospital, Pittsburgh, 1929–31; pathologist: St. Mary's Hospital, Southern Methodist Hospital; Wyatt Clinic, Tucson, Ariz., 1931–37. Member Arizona State Medical Society; American Medical Association; American Association for the Advancement of Science; American Rheumatism Society; Society of American Bacteriologists.

Labarus, Charles H., Lieutenant (DC) USNR (*Apicoectomy in War Dentistry*, p. 894). D. D. S., University of Buffalo, 1930. Private practice, Northport, N. Y.; member dental staff, North Country Community Hospital, Glen Cove, N. Y., 1934–. Member Suffolk County Dental Society; Second District Dental Society; New York State Dental Society; American Dental Association.

Legant, Omar, Lieutenant (MC) USNR (*Epidemic Dengue*, p. 856). A. B., Columbia University, 1935; M. D., College of Physicians and Surgeons, Columbia University, 1939. Intern, New Jersey State Hospital, Marlboro, N. J., Sept.–Dec. 1939, and Bellevue Hospital, New York, N. Y., Jan. 1940–Jan. 1942.

Lille, John J., Lieutenant Commander (MC) USNR (*Injuries of the Semilunar Cartilages of the Knee*, p. 798). B. S., Pennsylvania State College, 1926; M. D., Long Island College Hospital, 1930. Intern, Bellevue Hospital, New York, 1930–32; resident in pathology, Coney Island Hospital, 1932–33; resident in surgery, Kings County Hospital, Brooklyn, N. Y., 1933–34; instructor, assistant in surgery, Long Island College Hospital, Brooklyn, N. Y., 1934–42; assistant in surgery, Kings County Hospital, Brooklyn, 1935–42; associate in surgery, Brooklyn Cancer Institute, 1938–42; adjunct in surgery, Beth Moses Hospital, Brooklyn, N. Y., 1934–42.

McLaughlin, Robert R. M., Lieutenant Commander (MC) USNR (*Diffuse Scleroderma*, p. 921). M. D., Cornell University Medical School, 1930. Intern, Grasslands Hospital, Valhalla, 1930–31. Associate attending dermatologist, Dept. Correction Hospitals; associate attending dermatologist and assistant dermatologist out-patient dept., St. Luke's Hospital; assistant dermatologist, Vanderbilt Clinic; instructor, dermatology, College of Physicians and Surgeons, Columbia University. Member American Academy of Dermatology and Syphilology; American Medical Association; Society for Investigative Dermatology; diplomate American Board of Dermatology and Syphilology; fellow New York Academy of Medicine.

Misner, Samuel E., Lieutenant Commander (DC) USNR (*Postoperative Anesthesia in Dental Surgery*, p. 949). D. D. S., College of Dentistry, University of Tennessee. Private practice since 1924. Member American Dental Association.

Murphey, Phelps J., Lieutenant Commander (DC) USNR (*Lesions of the Mouth and Face of Special Interest to the Dental Officer*, p. 902). D. D. S., Baylor College of Dentistry, 1926. Postgraduate instruction: International School of Orthodontics, Dental Institute, University of Vienna. Consultant: Freeman Memorial Clinic; Texas Children's Hospital; Bradford Children's Hospital; private practice, Dallas, Tex. Member Dallas County Dental Society; Texas State Dental Society; American Dental Association; Dallas Academy of Dental Research. Associate Chicago Dental Society; American Society of Dentistry for Children.

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Nicholson, Jesse T., Lieutenant Commander (MC) USNR (*Fractures of Transverse Processes of Lumbar Vertebrae*, p. 780). B. S., University of Pennsylvania; M. D., University of Pennsylvania School of Medicine, 1928. Intern, Pennsylvania Hospital, 1928–30. Resident, orthopedics: Philadelphia Orthopedic Hospital, 1930–31; Shriners' Hospital for Crippled Children, Philadelphia, 1932; Johns Hopkins Hospital, 1932; Massachusetts General Hospital, Boston, 1933. Private practice, Philadelphia, 1934–42; assistant orthopedic surgeon: Graduate Hospital, University of Pennsylvania; Philadelphia General Hospital; orthopedic surgeon: Children's Department, Mary J. Drexel Home; Lankenau Hospital; Pennsylvania Hospital; Philadelphia Children's Hospital; Children's Seashore House at Atlantic City for Invalid Children; associate professor of orthopedic surgery, Graduate School of Medicine, University of Pennsylvania. Member Philadelphia County Medical Association; Pennsylvania State Medical Society; American Medical Association; Philadelphia Orthopedic Club; Philadelphia College of Physicians; Philadelphia Academy of Surgeons; American Board of Orthopedic Surgeons; Academy of Orthopaedic Surgeons; Interurban Orthopedic Club; American Orthopaedic Association; fellow American College of Surgeons.

Olds, John W., Lieutenant (MC) USNR (*Design for an X-ray Department at an Advance Base*, p. 935). B. S., Rutgers University, 1930; M. D., Rush Medical College, University of Chicago, 1936; M. S. in radiology, Mayo Foundation, University of Minnesota, 1939. Fellow Mayo Foundation, 1937–40. Certified (radiology) 1940. Associate roentgenologist, San Diego County General Hospital, Vauclain Home Unit; general staff, Mercy Hospital. Member California Medical Association; American Medical Association; American College of Radiology.

Pace, Nello, Lieutenant H–V(S) USNR (*A Tablet Emergency Ration for Lifeboats and Rafts*, p. 841). B. S., 1936, and Ph. D., 1940, University of California. Teaching assistant in physiology, 1936–39, and research assistant in physiology, 1939–40, University of California; research associate in physiology, Medical College of Virginia, 1940–41. Member American Association for the Advancement of Science; Society of Experimental Biology and Medicine.

Peterson, Thomas H., Commander (MC) USNR (*Injuries of the Semilunar Cartilages of the Knee*, p. 798). M. D., Northwestern University Medical School, 1926. Intern, St. Luke's Hospital, Chicago, 1925–27; assistant visiting surgeon, Boston City Hospital and New England Baptist Hospital; assistant visiting orthopedic surgeon, New England Medical Center; instructor, Harvard Medical School and Tufts Medical School. Member American College of Surgeons; Boston Orthopedic Club; American Medical Association; Massachusetts Medical Society. Diplomate American Board of Orthopaedic Surgery.

Rambar, Alwin C., Lieutenant Commander (MC) USNR (*Pooled Plasma Treatment of Mumps Orchitis*, p. 871). M. D., Syracuse University Medical School, 1926. Intern, Michael Reese Hospital, 1926–28. Aduncт pediatrician, Michael Reese Hospital; Chief of Premature Infant Clinic, Mandel Clinic; associate in pediatrics, Northwestern University. Member American Academy of Pediatrics; American Medical Association; Chicago Pediatric Socity. Diplomate American Board of Pediatrics 1939.

Schenck, Harry P., Captain (MC) USNR (*Eye Casualties Treated on a Hospital Ship*, p. 802). B. S., Haverford, 1918; M. D., University of Pennsylvania School of Medicine, 1923. Intern, University of Pennsylvania Hospital, 1923–25; research pathologist and research fellow in allergy, University of

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Schoenheit, Edward W., Lieutenant Commander (MC) USNR (*Comparison of Four Routine Procedures in the Treatment of Acute Catarrhal Fever*, p. 848). M. D., Jefferson Medical College, 1920. Associate medical director, Winyah Sanatorium, 1922–30; private practice, internal medicine, Asheville, N. C., 1930–; chief of staff, St. Joseph's Hospital, 1939–; staff member, Biltmore Hospital, 1931–; Member American Medical Association; Buncombe County Medical Society; North Carolina State Medical Society; Southern Medical Society; American Heart Association; fellow American College of Physicians; American College of Chest Physicians.

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Short, James J., Commander (MC) USNR (*Comparison of Four Routine Procedures in the Treatment of Acute Catarrhal Fever*, p. 848). M. D., University of Buffalo, 1918. Instructor: chemistry, New York Post-Graduate Medical School of Columbia University, 1918–20; medicine, College of Physicians and Surgeons, Columbia, 1921–23; instructor and associate, New York Post-Graduate Medical School, Columbia, 1923–30; associate clinical professor of medicine, 1931–. Chief of medical clinic and associate attending physician, New York Post-Graduate Hospital; research director and associate director, Life Extension Examiners, New York; director medical service, Department of Correction Hospitals, New York; attending physician, Welfare Hospital for Chronic Diseases, New York. Member New York County and New York State Medical Societies; American Medical Association; fellow American College of Physicians.

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Yandell, Hays R., Lieutenant (MC) USNR (*Experience in the Treatment of Burns*, p. 829). Ph. B., Yale University, 1929; M. D., Harvard Medical School, 1933. Intern, Lahey Clinic at New England Baptist Hospital, Boston, 1933; Geisinger Memorial Hospital, Danville, Pa., July 1933–July 1934; chief surgical resident, Geisinger Memorial Hospital, July 1934–July 1935; fellow in surgery, Cleveland Clinic Foundation, Cleveland, Ohio, July 1935—July 1937; associate in surgery and diagnosis, Niemann and Northcutt Clinic, Ponca City, Oklahoma, Oct. 1937–June 1941; private practice, Tulsa, Oklahoma. Diplomate National Board of Medical Examiners; member Tulsa County Medical Society; Oklahoma State Medical Society; fellow American Medical Association.

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BUREAU OF
CINE AND SURGERY
VY DEPARTMENT
ASHINGTON, D. C.

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COVER PHOTOGRAPH

Front line surgery lacks none of the operating room essentials but omits the frills. Vigilance against infection is no less, notwithstanding the substitution of skivvies for starched linen. The singularly high recovery rates for patients of hospitals such as this one on Bougainville testify to the skill and experience of the attached personnel. In this photograph a Naval medical officer is shown removing a slug from the thigh of a lieutenant in the U. S. Marine Corps.

—U. S. Marine Corps Photo.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, reports from various sources, and notes and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

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All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

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U. S. NAVAL MEDICAL BULLETIN

VOL. 42 MAY 1944 NO. 5

SPECIAL ARTICLES

COMBAT INJURIES IN THE SOUTH PACIFIC

LIONEL S. AUSTER
Commander (MC) U. S. N. R.

The difference between surgery of the last war and the gratifying results thus far attained in this one may be attributed to two factors; the simplification of surgical procedures and the effectiveness of present-day chemotherapy. To these must be added the ancillary advantage of rapid air transport for the evacuation of wounded to forward area medical bases.

Of approximately 11,500 patients treated at this South Pacific activity during the first 9-month period, 2,702 were classified in the category of "injuries" (Navy Nomenclature Class XXV). Many of them had multiple lesions. Aside from the group classified under "wounds, multiple," and "wound, gunshot," many wounded individuals were admitted with other primary diagnoses. On the other hand most of those included in the wound category had other conditions which in a small percentage of cases were listed under additional diagnostic classifications.

These 2,702 patients formed the largest single group treated except for those patients admitted for diseases transmitted by insect vectors. This latter group accounted for 24.42 percent. The period from October through January saw the heaviest patient load, with average daily admissions of about 60, the figures increasing to over 200 per day during periods of intense activity. Such times gave the greatest surgical load and provided the most dramatic, laborious, and satisfactory part of our experience. It became apparent in March that a change in the character of the cases admitted was definitely taking place, and by May a hitherto chiefly surgical hospital had become predominantly medical.

Of 2,043 patients with combat injuries, only 4 were admitted as from this base, 618 received their wounds aboard ships in naval action, and 1,421 were injured in action ashore. Of 659 noncombat injuries, 445 arose on this base and 91 upon ships, with 123 sent in from shore combat areas.

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With the exception of relatively small groups brought in by ships, most of our patients were evacuated from the combat areas by airplane and were seen 6 to 48 hours after injury. These patients included many survivors from ships, who were picked up, beached, and then rapidly evacuated.

The fact that most action took place at night meant that primary dressings were done and first aid was administered under trying conditions of darkness and terrain by medical personnel attached to combat units. The light from a small pocket torch was usually sufficient to provoke a burst of Japanese machine gun or sniper fire followed by mortar shells. Dressings therefore had to be applied by touch, sulfanilamide powder sprinkled and bandages applied, splints adjusted, and patients moved in the dark. Morphine syrettes were plentifully distributed and widely used. Plasma was often given in the field under cover of a poncho or tarpaulin.

Classification and further movement was directed from aid stations, and primary emergency surgery necessary in abdominal wounds, major hemorrhage, and severe compound fractures was performed by Naval medical officers at the Marine division field hospital where most wounds were inspected and redressed. Naval and Marine medical groups cared for all personnel until Army medical units began to function independently. Rapid evacuation of all but hopelessly ill or ambulatory medical cases was practiced because intermittent shelling and bombing through the day and night necessitated movement of litter and bed patients in and out of shelters several times a day.

With few exceptions therefore patients arrived with the original dressings placed by medical officers or corpsmen. They had received one or more doses of morphine. Plasma had been administered when indicated either in the field, in the division station, or on the plane. Most patients had received ½ cc. of tetanus toxoid as a booster. Some patients had had plaster casts applied before evacuation. Most fracture patients were transported in Thomas splints with shoe or hand traction, and were comfortable and in good condition upon arrival.

TYPES OF WOUNDS

The designations "wounds, multiple," and "wound, gunshot" form the largest single subdivisions in the break-down analysis, accounting for a total of 1,413. Cases listed under regional classifications, and also many instances of skeletal injury with fracture, which, because of the multiple or extensive nature of the lesions, were not primarily diagnosed as such, were included here. Not all the wounds were severe. Many patients had single small superficial wounds which required little more than a simple dressing. Others were peppered with small shell fragments which, like birdshot, covered a wide area and caused superficial discomfort and irritation. The term "gunshot

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wound" (GSW) however included many major injuries from smaller and larger pieces of so-called "shrapnel" (shell fragments) and segments of hand grenades. These ranged in nature from small, single-puncture wounds to areas of massive destruction with fracture, which in some instances even produced complete disintegration of large segments of bone.

Fragments, chiefly particles of bursting explosive bombs or shells, caused many bizarre and unorthodox injuries. Smaller fragments of irregular size usually were more numerous than clinical inspection could predict. The x-ray examination of these patients was made as soon after their admission as possible, constant service being available for processing and interpretation. Bomb and shell splinters were of variable size. They were usually at some distance from the wounds of entrance, having torn their way through the tissues until stopped, usually by bone which was damaged.

Grenades usually exploded into large segments and although their penetration was not particularly deep, they did much soft-tissue damage and produced disabling wounds. Fragments of structural members and "skin" of airplanes were frequently found in wounds after air battles in which missiles had splintered the metal parts of the aircraft. The steel-jacketed, sharp-nosed explosive bullet in enemy rifle fire resulted in many injuries characterized by relatively wide areas of tissue damage, due to the fragmentation of the bullet following explosion within the tissues after it had been stopped by a bone.

Ordinary bullet wounds were relatively innocuous. Through-and-through wounds were frequent and as long as vital areas were not injured, the parts healed rapidly, much as hot cautery puncture wounds. Wounds came to us caked with sulfanilamide power which provided a protective covering under the gauze or pad battle dressing and maintained the wound in clean condition. Surprisingly few of these wounds, even those of great extent, showed any infection, or other than mild inflammatory reaction. This is believed to be due to several factors. First, the cauterizing and sterilizing effect of the hot projectile fragment; second, the effectiveness of the sulfonamide dressing; third, the very effective protection afforded by active immunization with tetanus toxoid; and fourth, the minimum amount of handling to which these wounds were subjected.

A striking feature of injuries received in naval actions was the greater severity of the wounds and the almost universal occurrence of other lesions in conjunction with burns. Since an insistence upon adequate clothing following the Pearl Harbor experience, the extent and severity of flash burns have diminished. Except in men involved in actual conflagration, the flash burns were usually limited to hands and wrists, face, neck, and ankle regions. It is unquestioned that com-

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plete protection is afforded by even the lightest clothing; under combat conditions such clothing must be insisted upon.

Large numbers of the patients had retained foreign bodies in the form of metallic fragments of rifle bullets. Many of these were easily accessible, others were deeply situated and difficult to localize. X-ray films frequently showed dissemination of fragments over wide areas. These fragments defied attempts at complete removal. Large fragments often produced multiple areas of widespread soft-tissue destruction and associated compound fracture with extensive comminution and displacement. When bits of adherent mud and gravel entered the wound, purulent drainage occasionally occurred.

Removal or ignoring of shell splinters and fragments was guided by the fact that a bullet does no further damage after it has stopped moving unless it interferes with natural processes of healing or function, is in a position where it may erode vessels or viscera, interferes with the motion of a joint or muscle, or causes pain or disability by pressure. For these reasons most of the wounds containing fragments of large size, or falling into the categories given, were explored and fragments removed. Localization was often difficult and not always successful. X-ray pictures from different angles taken with metal markers fixed to the skin were utilized as guides. Small "silent" fragments were not disturbed. Experience has shown that except in rare instances the patient seldom returns for further treatment of these retained fragments in the absence of actual disability—unless he has been psychologically disturbed by the knowledge of their presence.

SKELETAL DAMAGE AND REGIONAL AREAS OF INJURY

The use of the improved type of steel helmet which is standard equipment for all forces has decreased the incidence of head injuries. Although there have been instances in which bullets and shell fragments penetrated the armor, they have been relatively few. Crushing injuries, complicated cranial damage due to falls and concussion, and forms of injury associated with compression of the helmet about the skull have been seen.

During the height of combat a conservative attitude in these cases was necessitated. Neither the time nor the equipment was available satisfactorily to undertake operative procedures except in the most urgent cases of compound comminuted and depressed fracture with compression or localized symptoms. Debridement and decompression was performed with a simplified armamentarium and the use of local or intravenous anesthesia with good results. Later opportunities permitted more elective cranial surgery.

The fortunate outcome in these cases, it is believed, resulted from careful selection of cases and adherence to the principle that, except

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in cases showing incontrovertible evidence of compression with focal signs, conservative management and delayed operation produces best results. Sulfonamides were not applied beneath the dura because of the later effects of synechial adhesions upon the cortex of the brain. However when infection occurs it is usually limited to external areas and to the accessory sinuses if they are involved.

There were instances of severe face and cranial injury resulting from major explosions, in which little but supportive treatment could be administered. Facial injuries were always treated from a plastic and reconstructive standpoint, as future cosmetic results in these cases depend in great measure upon the primary surgery. In cases in which plastic repair could not be completed immediately the tissues were prepared for subsequent reconstruction.

As a result of the infiltrating type of guerrilla jungle warfare in this area, especially the practice of Japanese snipers hiding in trees, bullet wounds of the neck, shoulders, and upper chest were frequent. The shoulder and upper chest wounds were usually through-and-through perforating lesions, with many bizarre injuries to the shoulder girdle and to the vessels and nerves in this region. Lacerations of arteries with resultant embarrassment of circulation occurring in both upper and lower extremities were recurrent problems.

Although these injuries, often associated with other distal lesions, usually eventuated in partial amputations, it is believed that much was accomplished by crymotherapy. With the object of reducing the metabolism of the part, diminishing the amount of necessary circulation and controlling pain, arms and legs in which circulatory embarrassment was present were packed in ice in rubber or oilcloth sheets and so maintained for days. A group of corpsmen especially assigned to these cases maintained constant watch. The relief from pain under this regime was immediate, requiring minimal morphine dosage for supplementary medication. Lines of demarcation developed, and infection was inhibited so that elective amputation could be performed after 1 week or more, with the patient in good condition. This technic unquestionably saved lives as well as extremities.

Wounds of the chest and chest walls were treated with the utmost conservatism. Except in the presence of open sucking wounds or foreign bodies, operative interference was reduced to aspirations of fluid accumulations when these became severe enough to embarrass respiration or produce inordinate febrile reactions. Imbedded shell fragments in the chest wall were usually removed. These foreign bodies were most often found in association with other shell fragment wounds. It is felt that active, early surgery in perforating wounds of the thorax is ill-advised unless absolutely necessary.

Penetrating wounds of the abdomen are of course serious. Most survivors with such injuries had fortunately been operated upon at

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the Marine division field hospital before evacuation to this base. Those who were seen here before abdominal exploration were in poor condition and their abdominal wounds were usually associated with other injuries of greater or less severity. Severe wounds of the buttocks and lower back usually produced injuries to abdominal or pelvic viscera. Protruding abdominal contents frequently complicated the picture. These are the cases in which early immediate operation is imperative.

In instances in which the stomach or small intestine was damaged, visceral repair, and treatment of the peritonitis and impending or actual ileus was frequently successful. Peritonitis resulting from wounds of the colon was fatal despite all supportive measures, including intraperitoneal sulfonamide, plasma and electrolyte infusions, and continuous indwelling intestinal suction drainage.

Compression and blast injuries to the abdomen resulting from underwater depth charge explosions in the vicinity of survivors from sinking ships have been termed "hydraulic abdominal concussion" and previously described.[1] These injuries, except in instances of frank perforation of the gut, should be treated expectantly without operation.

Fractures of all types were encountered. Fractures received in combat were usually compound, while those arising from operational accidents were more often simple. Severe fracture injuries with marked displacement, soft-tissue damage and hemorrhage had usually been debrided, reduced, and immobilized in plaster before evacuation. Thomas splints of all types were generally available at the point of evacuation, and most fracture patients arrived with such adequate temporary splinting, although splints were often made of bayonets, wood, wire mesh, and other materials readily available.

X-ray examination was made shortly after admission and further treatment procedures were instituted. Multiple fractures were not uncommon. A striking feature of many lesions was the loss of bone substance resulting from projectile explosions. Extensive debridement was done only in cases where there was evident widespread devitalization. Loose fragments of bone were removed unless they were clean, well attached to the shaft, and replaceable. Foreign bodies were removed and fractures reduced.

In only a few instances was skeletal fixation by the use of plates, screws, or wires employed, because of the lack of instruments and material and also because of the nature of the wounds. Well-leg splinting, skeletal traction in ring splints, banjo splints made of coat hangers for fingers, pins, and elastic bands fixed to a plaster cuff were used. Reliance was chiefly placed upon steel pins for traction-control of fragments, and upon sulfanilamide frosting under gauze

[1] AUSTER, L. S., and WILLARD, J. H.: Hydraulic abdominal concussion; syndrome of intra-abdominal underwater blast injury. J. A. M. A. 121: 995–999, March 27, 1943.

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packs in the wounds before reduction and immobilization in a plaster cast. The latter was placed with a minimum of pressure-point padding.

In the absence of the necessary machinery and precision instruments, hip-pinning was nevertheless successfully accomplished, and reduction with freedom from pain and infection achieved in the overwhelming majority of all fractures by the use of improvised Steinmann pins and yokes, and plaster fixation. Although the use of petrolatum gauze was not completely discontinued, packing wounds with large amounts of petroleum jelly or sulfonamide ointment was discontinued because these dressings exclude oxygen. In general also it is felt that the use of sulfonamides in ointments is ineffective, unless a water soluble base is used.

Despite the severe nature of many of the extremity injuries, only 17 legs and 8 arms were subjected to major or subtotal amputation and about 12 more digital and other partial removals were done. These operations were performed only after adequate consideration following a period of observation, and in most instances were precipitated by the development of gangrene of the parts.

The heavy volume of daily admissions and the overcrowding at this facility necessitated early and frequent evacuation of patients to rear bases whenever possible. This precluded follow-up observations on the majority of these patients. Reports of their subsequent course, however, have confirmed the adequacy of the early, simple, conservative measures. In the case of loss of continuity of bone substance particularly, the condition of the wounds and the undoubted presence of low-grade infection prevented the use of grafts or internal fixation. These fractures were fixed in traction.

Chief reliance for fixation was necessarily placed upon plaster of paris. In the compound fracture cases, the validity of claims for the Orr-Trueta technic was again affirmed. There were occasional cases of gas gangrene, usually in patients whose original reduction and immobilization had been done in the field and were not disturbed after admission. A characteristic of these cases was the sudden "blow-up" which developed after an interval of seeming well-being. Conservative therapy was tried in many instances with free incision and excision, chlorinated wet dressings, liberal gas bacillus antitoxin administration, oral administration of sulfathiazole, and the use of x-ray therapy. The unsatisfactory course of these cases and the rapidly progressing toxemia usually forced amputation. Subsequent policy therefore called for early amputation in cases of gas gangrene. This proved lifesaving in many instances.

A curious lesion was the so-called "deck fracture" of the os calcis, usually bilateral, which could be sustained in jumping from a higher level, but usually was the result of explosion below the deck upon

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which the individual was standing. Objective findings varied from slight tenderness with questionable sprain to massive subcutaneous hemorrhage and ecchymosis with marked deformity. X-ray examination with rare exception showed fracture of the os calcis. Treatment was conservative with mallet and compressor molding and plaster case fixation after subsidence of swelling.

THERAPEUTIC PROGRAM AND MANAGEMENT OF WOUNDS

Patients were brought from the airport in ambulances, and both litter and ambulatory patients were brought to a large receiving ward where they were examined, classified, and assigned to wards. Morphine and plasma were administered in the receiving ward when indicated and each patient with a wound or burn received a booster of ½ cc. of tetanus toxoid unless specific written statement of immediate prior administration appeared on his casualty tag. Most patients were sent to the x-ray department from the receiving ward before transfer to their final wards, in order to eliminate unnecessary handling. Some patients were retained in the receiving ward until their turn came for removal to the surgery, where definitive treatment was administered before admission to the ward hut.

All patients had urinalyses, blood counts, and hemoglobin determinations upon admission. Malaria smears were taken and, pending report, prophylactic atabrin (1½ grains per day) was administered. If plasmodia were present in the blood or there was clinical evidence of malaria, quinine, atabrin and plasmochin over a period of 10 days, followed by a continued low dosage of atabrin for at least 1 month, was the rule.

All wounded or burn patients were checked for tetanus toxoid booster dosage which was entered upon the record. Combined tetanus-gas bacillus prophylactic antitoxin was given in severe wounds after skin testing. Oral administration of sulfathiazole in divided doses totaling 4 to 5 gm. daily was routinely practiced for the first 3 days in all wounded patients. Multiple vitamin pills were given daily to all patients from the combat areas and ferrous sulfate pills when indicated, especially in recurrent malaria with anemia. Diarrhea was treated with sulfaguanidine and bismuth-paregoric mixture.

Many wounds required only dressing and treatment which could be administered on the ward. Washing with white soap and water, shaving, and drying with ether-alcohol was the first step. Replacement of sulfanilamide powder frosting and simple dressing was frequently all that was necessary. Tincture of merthiolate was the antiseptic of choice. When wet dressings were indicated azochloramid (aqueous solution) was used freely.

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More extensive treatment was given in the operating rooms. Thorough debridement was done only in cases of severe injury with large areas of tissue destruction either externally visible or found after enlargement of the wound for removal of retained fragments. Most debridement, after the primary cleansing with soap and water, benzine and ether, consisted in removal of ragged edges and superficially damaged tissues. Foreign bodies were removed. Drainage was instituted in deep wounds or when evidence of infection and inflammation was found. Microcrystalline sulfanilamide powder was liberally instilled and sterile dressings applied after removal of shell fragments, debridement, and reduction of fracture.

Wounds were not sutured. The absence of wound infections either in patients arriving here or subsequent to treatment at this base is noteworthy. Subsequent dressings were reduced to a minimum. It was found that under conditions of latent infectivity present in those patients, the less handling these wounds received the better the prognosis. After a short period of early drainage of blood and tissue fluids most of them healed asymptomatically.

In view of the fact that the combat terrain and the hospital compound was almost constantly muddy and covered with dense vegetation in various stages of decay, mixed with droppings of cattle and other animals, the infrequency of pyogenic, tetanic or gas infections was remarkable. Even in our operating rooms it was impossible to maintain conditions of more than casual sterility, working as we did in sweat-drenched shorts when gowns were unavailable, the mud and coral caked upon our boots mixing with blood and water upon the deck, and the constant movement of necessary personnel about the rooms. The atmosphere was constantly and unavoidably laden with bacteria. (See cover.)

Only two cases of clinical early tetanus were seen. Both were recognized and treated energetically with control of the infection and symptoms in 36 hours. The incidence of gas bacillus infections as previously mentioned was also unaccountably low. This is attributed to the effectiveness of immunizing measures used here, the properties of the sulfonamide drugs, the restraint practiced in operative surgery, and above all, the ability of the human body successfully to withstand serious injury.

Anesthesia.—Spinal anesthesia was employed for abdominal or extensive lower extremity surgery, using procaine hydrochloride crystals dissolved in spinal fluid. Ephedrine sulfate in ¾-grain doses, routinely administered by hypodermic injection prior to spinal puncture, effectively controlled adverse blood pressure reactions. Preliminary medication usually consisted of barbiturates followed by morphine and atropine given at least ½-hour before operation when

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time permitted. Local infiltration novocain anesthesia was frequently employed in debridement and treatment of fractures. Intravenous pentothal-sodium was the anesthetic of choice for most general surgery. There were no anesthetic accidents.

Mortality.—During the 9-month period of this survey there were in over 11,000 admissions 46 deaths from all causes. Deaths from injuries totaled 36, of which 27 were combat and 9 noncombat injuries. The deaths from disease were equally divided between personnel from combat and noncombat areas. The mortality rate is 0.39 of 1 percent.

SUMMARY

The majority of patients evacuated from the combat areas of the eastern Solomons were treated at this hospital. It has been variously estimated that over 50 percent of the surgery performed in the South Pacific area since the onset of the Solomon Islands operations was performed by officers attached to this facility. While shortage of personnel and lack of adequate materials made refinements of technic impossible, it was again demonstrated that simple procedures based upon sound surgical principles were eminently successful.

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PATULIN

Patulin is a relatively simple organic compound. It is a colourless, crystalline material, soluble in most of the common solvents, stable in solution at pH 6, and produced in quantities up to 1 percent or more of the mother liquor of mould cultures. It is reported that patulin was effectively bacteriostatic against both Gram-positive and Gram-negative organisms *in vitro*, and when given as a nose and throat spray at concentrations of from 1 in 20,000 to 1 in 5,000 in a suitable vehicle every 4 hours to some 100 patients, it increased the 48-hour recoveries by from 4 to 20 fold over that of an approximately equal number of patients who received a "blind test" or placebo of the vehicle only.

The drug is stated to act within an hour or so with symptomatic relief, which suggests that it may have decongestive and perhaps local anaesthetic properties, although these pharmacological actions have not yet been studied. A concentration of 1 in 2,000 inhibits the phagocytic activity of leucocytes and the drug is locally toxic when injected; this, together with the fact that in lethal doses it causes increased capillary permeability with oedema and haemorrhage of the lungs, liver, spleen, kidneys and brain, indicates that patulin is to be used with some respect and caution. It has also been reported that in another investigation done elsewhere patulin has not been found to be as effective a remedy as would be deduced from the above. It has been reported to be ineffective against influenza.—Boyd, E. M.: Patulin. Canad. M. A. J. 50: 159, February 1944.

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EARLY CARE OF FACIAL WOUNDS

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Wounds of the face are of relatively infrequent occurrence during the present conflict in the South Pacific area. In the first 4 months of operation of this hospital approximately 80 patients were admitted to the head and neck ward. This does not include those patients admitted to general surgical or orthopedic wards with multiple wounds in which injury to the face and head was considered of less importance than their other wounds. These latter cases were handled in conjunction with the general surgical or orthopedic services, and surgery performed included the removal of foreign bodies, reduction of fractures, local debridement, and closure of defects when possible.

Facial injuries as seen in this hospital may be divided into simple and complicated injuries. The former involved merely the soft tissue of the face, while in the latter, which constituted the majority, the injury communicated with the oral cavity, paranasal sinuses, or the bony framework of the face.

Wounds of the soft tissues alone were usually clean upon arrival. They had been treated previously with one of the sulfonamide powders and the wounds left open. Definitive treatment consisted of warm saline irrigation of the wound upon arrival, redusting with sulfathiazole powder, and application of hot saline compresses. After several days, closure of the wounds could be done and healing usually occurred without further incident. Wounds which were infected on admission were for the most part those in which primary suturing had been done early. They were treated as any infected wound by reopening, drainage, and application of hot saline or boric compresses. All patients received sulfathiazole orally and topically.

Wounds which were complicated by injury to the mandible were treated in conjunction with the dental department. The jaw was immobilized as soon as possible while the external wound was left open and treated by local application of sulfathiazole powder.

Injuries to the floor of the mouth were often infected and a certain amount of sloughing was present. Slough areas were excised and the mouth irrigated frequently with warm saline or aqueous azochloramid. No attempt should be made to close wounds in this area because of the danger of infection extending into the neck.

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Fragments of facial bones, if still attached to the soft tissue, were left in place, loose fragments were removed, and the wound was treated conservatively. These wounds were usually infected by contamination from communication with the oral cavity. It was remarkable how soon the infections would clear by the daily removal of slough and daily irrigations and hot fomentations. In cases of cheek defect, as soon as was deemed safe after the infection had cleared, the mucous membrane was sutured to the skin in order to prevent further retraction of the tissues. If enough tissue remained the wound was closed.

One of the chief problems encountered in the care of these patients was that of feeding. Most of those with wounds involving the oral cavity were fed by nasal catheter. A number of patients were able to feed themselves by using a bulb syringe.

Complications encountered during the early period following injury were:

1. Infection.—This was the most common complication seen in those cases in which there was communication with the mouth, sinuses, and nasal cavity. This cleared within 5 or 6 days by careful debridement, the use of hot fomentations, and administration of one of the sulfonamides.

2. Obstruction to airways.—In four cases tracheotomy had been done prior to admission to this hospital because of obstruction to respiration. It was possible to remove the tubes from three of these patients within 24 to 48 hours after admission.

3. Hemorrhage.—In only one case was latent hemorrhage a problem. This was a "shrapnel" wound of the submaxillary region and floor of the mouth. No further hemorrhage was encountered after ligation of the external carotid artery.

It is concluded that facial wounds should be treated as if they were infected for a period long enough to be sure of a clean field before closure is made. Attached bony fragments should be left in place, and in general as little debridement as possible should be done.



PENICILLIN ORALLY

Saliva, bile, and succus entericus obtained from man do not inactivate penicillin. Gastric juice destroys this antibacterial substance rapidly, especially at body temperature. Hydrochloric acid, and not pepsin, is apparently responsible for this action of gastric juice.

In two subjects with pernicious anemia the absorption of penicillin when administered by mouth, was greater than that observed in normal subjects.—RAMMELKAMP, C. H., and HELM, J. D., JR.: Studies on absorption of penicillin from stomach. Proc. Soc. Exper. Biol. & Med. 54: 324–327, December 1943.

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PERFORATING WOUNDS OF THE CHEST

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The following is a brief review of 237 patients with perforating wounds of the chest seen on the surgical service of this hospital during a 7-month period. One hundred fifty-three of these cases were multiple fragment wounds, the chest injuries being only part of the general picture. In 84 cases the chest alone was involved, and 61 of these were through-and-through bullet wounds made by small caliber ammunition.

These patients were received directly from the combat area via ambulance planes within a few hours to 3 days after the wounds were incurred, the average length of time from injury to admission to the hospital being 24 hours. All patients had received first-aid treatment consisting of morphine, sulfonamide powder, wound dressings, tetanus toxoid, and oxygen and/or plasma when indicated.

The symptoms on admission varied from only slight discomfort to severe pain and dyspnea. The latter was present in practically all cases, and varied in severity directly in proportion to the amount of hemothorax present. When there was massive hemothorax with displacement of the mediastinum, dyspnea was extreme. In other patients, with fixed trachea and mediastinal structures, there was less tendency for this extreme dyspnea than in younger patients in whom these structures had not been fixed by adhesions from past disease.

Cyanosis was not a prominent feature in these patients. This was probably due to the fact that they were flown to us at low altitudes and given oxygen if needed. Nearly all complained of varying degrees of pain, but it was severe in not more than 10 percent. Pain was of a dull, heavy type and in most instances very little opiate or other sedation was necessary. Anxiety was a feature in patients with marked dyspnea. Shock was prominent in only one case. This condition had apparently been successfully combated at first-aid stations and with competent care by surgeons and corpsmen on ambulance planes before the patients were received here. It is interesting to note that none of these patients showed spasm of the glottis. Most of them had hemoptysis, but none to a marked degree.

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Physical findings in patients with through-and-through wounds of the chest made by small caliber ammunition were, in nearly all cases, not significant except for very small, clean wounds of entrance and only slightly larger wounds of exit. There was rarely a hemothorax of importance, but one patient had moderate pneumothorax. There was seldom any history of shock. Most of these patients were symptom free on admission and remained so, requiring remarkably little care.

Physical findings in perforating wounds caused by bomb fragments made a diverse and often startling picture. Some of these patients had large, open wounds, large enough to admit the hand, and when properly packed with sulfonamide powder dressings, were found to be in remarkably good condition. Those patients in whom the chest had been perforated by bomb fragments, leaving closed wounds, were our most serious cases. There was nearly always a marked hemothorax with some accompanying pneumothorax. Many showed mediastinal shift due to this condition. All patients with considerable hemothorax or large, open chest wounds naturally had marked secondary anemia.

The scope of this paper will not permit a detailed discussion of treatment. Only a few salient points will be considered. Plasma was used freely. All patients with even a moderate anemia were given blood transfusions. Cases of pneumothorax with only small amounts of blood in the chest, in the absence of infection, were left entirely alone except for the use of sulfonamides by mouth. Those with any considerable quantity of blood in the chest were routinely aspirated, with air replacement to conform to half the amount of blood removed. No effort was made to clear any chest to the point of dryness. Blood was removed only in sufficient quantity to facilitate easier breathing, relieve cardiac embarrassment and shorten hospitalization. Nearly all blood aspirated showed the presence of microorganisms, yet no patient developed a definite empyema. It is realized of course that this may have developed in some of our patients after they were evacuated. Large, open sucking wounds were packed to the point where they were airtight, and early closure was done as soon as consistent with safety.

The use of sulfathiazole orally was routine in all cases. No toxic manifestations from the drug were noted. Eighty percent of our patients ran a low-grade febrile course for 3 to 5 days; all who presented any remarkable degree of hemothorax ran temperatures ranging from 100° to 103° F. for several days. These were not influenced by the sulfonamides.

Complications were rare. Approximately 8 percent of these were demonstrable localized pneumonitis, but none of any severity. Delayed, secondary hemorrhage was rarely seen, and never in consider-

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able amount. Fatal embolism was seen in one case. Foreign bodies were only rarely complicating factors and were seldom removed. Gas gangrene was thought to be a complicating factor in one patient to be mentioned later.

There were only two patients who required major surgical procedures. These were done without benefit of intratracheal anesthesia or positive-pressure apparatus, which was not available.

CASE REPORTS

One of these patients was a 17-year-old Marine. He had thrown a hand grenade too quickly after pulling the pin and a Japanese soldier had caught it and thrown it back. It exploded in midair just behind the Marine's thorax. Fragments penetrated the right scapula, ranged downward through 2 ribs, and became embedded in the lower lobe of the right lung. When the patient was admitted 24 hours later, the right side of the chest was found to be entirely splintered. Dyspnea was marked even with oxygen inhalation in the sitting position. He was irrational, pulseless, and presented the picture of a dying man. His red blood cell count was 2,320,000.

X-ray revealed a massive hemothorax with diffuse air bubbles throughout, and 6 grenade fragments embedded in the right lung base posteriorly. Operation was done 2 hours after admission. Under local anesthesia and oxygen inhalation, a flap was turned down on the lateral aspect of the right chest, involving section of the 5th and 6th ribs. Since the operation had to be done with the patient in a sitting position it was easy to view the thoracic contents. Approximately 2 liters of foul-smelling blood were let out slowly, giving a full view of the collapsed lung which was torn for a distance of about 3 inches. The grenade fragments could be felt but attempt at removal initiated so much hemorrhage it was abandoned. Fragments of bone were removed from the cavity and the chest was closed tightly around a hard rubber tube. The patient left the operating table in good condition and was able to breathe lying down without benefit of oxygen administration.

A smear made from the evacuated blood showed an unidentified anaerobe. The patient was given a blood transfusion and 180,000 units of gas gangrene antitoxin when he returned to the ward. He was evacuated 3 weeks later in good condition.

The second patient was a 20-year-old sailor. A nearby spent bomb fragment had punctured the left chest anteriorly through the 3d rib. A small piece of clothing was protruding from the wound and could not be pulled out. This patient did not appear very sick and was conscious and cheerful. X-ray revealed a large bomb fragment lying in the upper portion of the chest cavity with pneumothorax and very little blood in the chest. Excision of the wound was done and a flap of the 3d rib laid back. The large fragment together with considerable shirt material was removed. The wound was closed and early recovery resulted.

There were only 2 deaths in this series of 237 chest wounds. One of these patients died 20 minutes after entry to this hospital and before any treatment other than plasma had been instituted. Because of pressure of work on other casualties, no autopsy was done. The other

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fatality was a soldier who had entered the hospital in a critical condition, but with supportive measures and three aspirations was apparently convalescing, when he suddenly collapsed and died within a few minutes. Autopsy revealed that death was the result of a cerebral embolism.

CONCLUSIONS

1. Small-caliber bullet wounds of the chest unless involving vital structures are seldom fatal and convalescence is short and uneventful.
2. Patients surviving the initial shock of perforating wounds of the chest, even if severe, usually recover under conservative treatment.
3. Major surgical measures are seldom necessary. Such procedures can, however, be done when necessary without the benefit of intratracheal anesthesia or positive-pressure apparatus.
4. The sulfonamides are of definite benefit but must be accompanied by other supportive measures.
5. Competent care at first-aid stations and in transportation is responsible for much of the success in the treatment of this type of injury.

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DICOUMARIN

Dicoumarin, the active biologic principle of spoiled sweet clover responsible for the hemorrhagic disease in cattle, has been used in a number of intravascular disorders, especially thrombophlebitis. However, all investigators are in unanimous agreement that careful study of the coagulative properties of the blood should be made during the administration of this compound since great variability in response has been encountered.

In addition to the unpredictable response obtained from the oral administration of dicoumarin, a period of twenty-four to forty-eight hours elapses before any change in the coagulation properties of the blood is apparent. This "latent period" makes dicoumarin undesirable when immediate disruption of the clotting mechanism is indicated. Heparin, on the other hand, does not exhibit a prolonged "latency" of effect, the response being obtained within one hour. Dicoumarin and heparin may be used simultaneously since these agents do not counteract each other and each has a different mode of action. Heparin affects the coagulation of the blood directly, whether in vivo or in vitro; i. e., it inhibits some part of the mechanism (thromboplastin), thus forestalling clotting, while dicoumarin exerts its effect presumably on the prothrombin-producing organs of the body, with the result that a prothrombin deficiency develops consequent to the inhibition of blood clotting.—BRAMBEL, C. E., and LOKER, F. F.: Application of dicoumarin (3,3′-methylene-bis-[4-hydroxycoumarin]) in trauma and gangrene. Arch. Surg. 48: 1–16, January 1944.

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POSTOPERATIVE URINARY RETENTION

A CLINICAL STUDY OF 1,964 NAVAL RECRUITS SUBJECTED TO GENERAL SURGICAL PROCEDURES

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The problem of urinary retention following surgery of the abdomen and perineum, one of the most frequently encountered postoperative complications, has been the subject of investigation over a period of years. The majority of these reports have dealt with small series of patients seen in civil practice, including both sexes, and individuals ranging in years from youth to advanced age. While such studies represent an accurate analysis of the material reported, associated pathologic conditions often make it extremely difficult to draw any conclusions.

During an 11-month period 1,964 general surgical procedures for the correction of abdominal, inguinal, perineal, or rectal lesions were carried out on Naval recruits in this activity (table 1). These young men ranged in age from 17 to 35 years, but over 90 percent of those admitted for surgical treatment were between 17 and 25 years of age.

TABLE 1.—*Postoperative urinary retention in 1,964 general surgical procedures*

Month	Inguinal hernia	Cryptorchism. Varicoceles. Hydroceles	Miscellaneous abdominal procedures	Appendicitis	Rectal surgery	Total surgical cases	Patients catheterized	Percentage catheterized
November	70	14	0	15	2	101	16	15.8
December	140	7	2	46	5	200	41	20.5
January	123	16	0	45	20	204	55	26.9
February	121	12	0	68	15	216	46	21.3
March	136	12	1	59	25	233	15	6.4
April	76	18	10	15	12	131	1	0.76
May	79	18	5	16	11	129	1	.75
June	138	14	8	25	28	213	0	0.
July	147	12	5	34	29	227	7	3.0
August	60	5	1	20	16	102	3	2.9
September	136	5	7	31	29	208	10	4.8
Total	1,226	133	39	374	192	1,964	195	*Average* 9.8

Blalock has listed the common causes of postoperative urinary retention as follows: Organic nerve disorders; urethral injuries; vesical calculi; foreign bodies in the urethra; contractures of the vesical

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neck; intravesical or intraurethral infections or tumors; infection, benign hypertrophy or malignancy of the prostate gland; urethral strictures; pelvic tumors and various operative procedures.

The patients in this study were admitted for the repair of correctable defects existing at the time of enlistment or with acute surgical lesions developing during basic training. They were young men in excellent general physical condition, singularly free from organic urologic disease, who were subjected to general surgical procedures. A rather unique opportunity was thus afforded to study the incidence and means of controlling postoperative urinary retention without consideration of the many complicating factors usually encountered in such series.

The vast majority of the surgical procedures carried out were those requiring incisions in the lower abdomen, inguinal regions and perineum (table 1). Inguinal herniorrhaphy, appendectomy, and hemorrhoidectomy were the most common operations in the order named. All of these procedures are associated with a high incidence of postoperative urinary retention because of their anatomic proximity to the bladder. In the entire series the frequency of urinary retention was consistently higher following appendectomy than after herniorrhaphy, and only one of the patients subjected to hemorrhoidectomy or other rectal procedures required catheterization (table 2).

TABLE 2.—*Urinary retention following various types of surgical procedures—1,964 cases*

Month	Hernia all types			Laparotomies			Rectal surgery			Total patients cath.	Total catheterizations
	Number of cases	Number cath.	Percent cath.	Number of cases	Number cath.	Percent cath.	Number of cases	Number cath.	Percent cath.		
November	84	11	15.7	15	4	26.6	2	0	0	16	61
December	147	29	19.7	48	12	25.0	5	0	0	41	178
January	139	40	28.7	45	15	33.0	20	0	0	55	248
February	133	28	21.0	68	18	26.4	15	0	0	46	108
March	148	9	6.0	60	6	10.0	25	0	0	15	30
April	94	1	1.3	25	0	0	12	0	0	1	1
May	88	1	1.1	16	0	0	11	0	0	1	2
June	152	0	0	28	0	0	28	0	0	0	0
July	152	3	1.9	34	4	11.7	28	0	0	7	7
August	65	3	4.6	21	0	0	16	0	0	3	3
September	136	2	1.4	38	7	18.4	29	1	3.4	10	13
Total	1,338	127	9.5	398	66	16.5	191	1	.5	195	651

The postoperative nursing care of these patients was given by hospital corpsmen under the direction of the ward surgeon and the nurse in charge. Education of the ward personnel in the common methods of reducing the incidence of postoperative urinary retention was undertaken. They were instructed to screen patients from their ward companions, apply hot-water bottles to the lower abdomen,

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warm the urinals, pour warm water over the genitalia and elevate the backrest to a high Fowler position. These steps were all undertaken within 8 hours after the patient's return to the ward from the operating room and repeated at frequent intervals if unsuccessful.

Individuals operated upon for inguinal hernia, nonperforated appendicitis, and rectal lesions were occasionally allowed to stand at the bedside with support if still unable to void in 12 to 18 hours. In the first group of cases no patient was permitted to go without voiding for a period longer than 18 hours following surgery.

In spite of the increasing experience of the corpsmen and constant supervision of the methods employed to combat urinary retention, the incidence for the first month of this study was 15.8 percent, for the second 20.5 percent, and for the third 26.9 percent (table 1). During this period it was observed that each patient catheterized required a repetition of this procedure on the average of three occasions. In the second and third months of this study it was noted that 28 percent and 24 percent of all patients with urinary retention were still unable to void spontaneously after four catheterizations.

Although strict aseptic technic was adhered to, overdistention avoided and argyrol instilled following catheterizations, cystitis of varying degree inevitably developed in those patients catheterized in excess of ten times. This experience led us to investigate the value of prostigmine as an additional aid in the prevention of postoperative urinary retention.

Prostigmine has for several years been recommended as a valuable therapeutic agent in the care of surgical patients, not only to maintain intestinal tonus and reduce the incidence of paralytic ileus, but to reduce the frequency of postoperative urinary complications. To test its value in the latter complication, the drug was administered to this carefully controlled group of young males.

Several different plans of treatment were employed, and to evaluate the effectiveness of a given program, the cases were divided into different groups for comparative study (table 3).

TABLE 3.—*Results of prophylactic therapy in eight groups of cases*

	Surgical cases	No. developing retention	Total catheterizations necessary	Percent retention in group
Group 1	401	87	387	21.6
Group 2	320	71	208	22.1
Group 3	233	15	30	6.4
Group 4	131	1	1	0.76
Group 5	342	1	2	.29
Group 6	227	7	7	3.0
Group 7	102	3	3	2.9
Group 8	208	10	13	4.8
Total	1,964	195	651	9.8

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Group 1 consisted of the 401 patients operated upon during the first 2½ months, terminating on 15 January. During this period emphasis was placed upon instruction of the ward corpsmen in the use of all conservative measures to facilitate spontaneous voiding. These included those procedures previously mentioned, but patients who had undrained appendices or had had herniorrhaphies and rectal operations were not routinely permitted to stand at the bedside to void before resorting to catheterization. None of these patients was permitted to retain urine longer than 18 hours following operation. No prostigmine was used in the treatment of this group.

Eighty-seven patients (21.9 percent) developed postoperative urinary retention and required a total of 387 catheterizations. Several individuals in this group were still unable to void after being catheterized fifteen times, and in these cystitis almost always developed, resulting in a prolonged period of treatment (table 4).

TABLE 4.—*Analysis of catheterizations necessary in 195 patients with postoperative urinary retention*

No. of catheterizations	Group 1 cases	Group 2 cases	Group 3 cases	Group 4 cases	Group 5 cases	Group 6 cases	Group 7 cases	Group 8 cases	Total	Percentage of total patients with retention
1	44	37	10	1	0	7	3	8	110	56.4
2	16	10	1	0	1	0	0	1	29	14.9
3	7	6	2	0	0	0	0	1	16	8.4
4	3	4	0	0	0	0	0	0	7	3.5
5	2	1	0	0	0	0	0	0	3	1.5
6	5	4	2	0	0	0	0	0	11	5.6
7–10	3	3	0	0	0	0	0	0	6	3.0
10–15	3	3	0	0	0	0	0	0	6	3.0
15–20	2	2	0	0	0	0	0	0	4	2.0
20–25	1	0	0	0	0	0	0	0	1	.5
Over 25	1	1	0	0	0	0	0	0	2	1.0
No. patients catheterized	87	71	15	1	1	7	3	10	195	100.0
Total catheterizations	387	208	30	1	2	7	3	13	651	.....

Group 2 included 320 cases coming to surgery in the succeeding 1½ months (15 January to 1 March). In the treatment of this group the conservative measures employed in the previous group were continued. In addition prostigmine 1:4,000 solution was given in 1-cc. doses to each patient on return from surgery and repeated at 4-hour intervals for 9 doses. With this addition in therapy no perceptible improvement was noted as regards the incidence of urinary retention. Seventy-one patients were unable to void following surgery, an incidence of 22.1 percent, requiring a total of 208 catherizations. There was no increase in the number of patients able to void spontaneously after 1 catheterization in this group, but the number of catheterizations necessary for each individual developing urinary retention was reduced from 4.4 percent to 2.9 percent.

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Group 3 was composed of the 233 patients operated upon during the month of March. An identical form of therapy was employed in this series of cases except that all patients who had undrained appendices, or had had herniorrhaphies and rectal operations and were unable to void 12 hours after operation, were permitted to stand at the bedside with support. Those unable to void on standing were lifted into a wheel chair and moved to the head if necessary. These measures were considered entirely safe since cotton suture material was routinely used for closure of all inguinal and abdominal wounds.

In this series of patients and all subsequent ones, a period of 24 hours was permitted to elapse following operation before resorting to catheterization, unless the patient was in evident distress. Prostigmine was given this group of cases in 2-cc. doses of a 1:4,000 solution, a total of 9 injections being given at 4-hour intervals following surgery. With these changes in therapy there was a striking reduction in the incidence of postoperative urinary retention. Only 15 patients among the 233 developed retention, requiring a total of 30 catheterizations. It was also noted that in this group, 67 percent of those requiring catheterization on 1 occasion, were subsequently able to void spontaneously.

Group 4 consisted of 131 patients coming to surgery during the month of April. All therapeutic measures employed with group 3 were continued in this series, as was the prostigmine in the same dosage as above. The only change was that the first injection was given at 0600 on the morning of operation, the second on the patient's return from surgery, and the remaining 6 injections at 4-hour intervals. With this program of therapy only 1 patient required catheterization on 1 occasion, an incidence of 0.76 percent urinary retention for this group of cases.

This striking reduction in the incidence of this troublesome postoperative complication was so dramatic that it seemed worthy of a very careful analysis. Several factors had to be considered: (1) The extent to which the increasing experience and interest on the part of the corpsmen and nursing personnel contributed to the improved results; (2) whether administration of prostigmine in the given strength and dosage to groups 3 and 4 was entirely responsible for the reduction in the incidence of urinary retention; (3) the possible influence of spinal anesthetic agents; (4) the importance of permitting these patients to stand at the bedside to void in reducing the incidence of retention; and (5) the practice of increasing the period from 18 to 24 hours after surgery before insisting that the bladder be emptied.

There can be no doubt that the increased skill of the hospital corpsmen was a real factor. They made this problem a personal one, each group assigned to a surgical ward striving to keep the incidence as low as possible. Coupled with this they developed a profound faith

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in the medication being given, and it was felt that perhaps this confidence was passed on to the patient to his ultimate benefit. To evaluate the influence of these two factors, an additional group was observed in which the therapy was slightly altered.

Group 5 consisted of 342 patients operated upon during May and June with whom all conservative measures employed with groups 3 and 4 were continued, including standing and being moved to the head when necessary. All prostigmine was removed from the ward and in its place was substituted sterile normal saline solution in rubber-stoppered bottles. The sterile saline was given in 1-cc. doses at 4-hour intervals for a total of 8 doses. None of the ward personnel was informed as to the nature of the solution employed during this period of the study.

In this series of 342 consecutive cases 1 patient required catheterization on two occasions, a percentage incidence of 0.29. Forty-four patients (12.8 percent) required standing on one or more occasions to void, and 33 patients (9.6 percent) were of necessity moved to the head. These measures were unsuccessful in only 1 case, but we may consider that the 22.4 percent who required them were potential candidates for catheterization.

We could only conclude from a study of the 342 patients in group 5 that the prostigmine had not been primarily responsible for the striking improvement in reducing the incidence of postoperative urinary retension. Credit would seem to go to the corpsmen and nurses for making this a problem of special interest, their constant assurance of the individual patient that he could void normally, and to a lesser extent a routine permitting these patients to stand or be carefully moved to the head on one or two occasions when necessary.

TABLE 5.—*Anesthesia and incidence of postoperative urinary retention*

Month	Surg. cases	Spinal anesthetic		N_2O	Pentothal sodium	No. pts. cath.	Percent with retention
		Metycaine	Novocain				
November	101	92	2	0	0	16	15.8
December	200	195	5	0	0	41	20.5
January	204	187	17	0	0	55	26.9
February	216	195	13	0	8	46	21.3
March	233	100	101	14	18	15	6.4
April	131	9	116	2	5	1	.76
May	129	0	120	4	5	1	.75
June	213	176	33	2	2	0	0
July	227	1	224	0	2	7	3.0
August	102	0	102	0	0	3	2.9
September	208	0	204	2	2	10	4.8
Total	1,964	955	937	24	42	195	.....

Any idea that the type of spinal anesthetic agent might have been a factor was readily disproved. A review of table 5 might seem to suggest that metycaine, which was employed during the first 4 months

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of this study when the incidence of urinary retention was high, served as a contributing factor. The marked reduction in the frequency of urinary retention coincided with the employment of novocain crystals as the anesthetic agent during the months of April and May. However a return to metycaine during the 8th month of this study (June) was accompanied by no increase in urinary retention, so we may conclude that the type of medication employed for the spinal anesthetic was not in itself a factor.

Groups 6, 7, and 8 (table 5) were observed during the last 3 months of this study, in order to clarify certain points and to check our former observations. Group 6 consisted of 227 patients operated upon during the month of July. The patients were each given 1 cc. of 1:2,000 prostigmine at 0600 on the day of operation and at 4-hour intervals following surgery, for a total of 8 doses. None, however, was permitted out of bed to void. Twenty-four hours after operation was set as the time limit before resorting to catheterization, or a shorter period if the patient was in definite distress. Seven patients in this group required catheterization on 1 occasion each, an incidence of 3 percent.

In group 7 were 102 patients who were treated in an identical manner as was group 6, except that sterile normal saline solution was again substituted for prostigmine without knowledge of the ward personnel. None of these patients was permitted out of bed or moved to the head to void. Three patients in this series required catheterization on one occasion each, an incidence of 2.9 percent urinary retention for this group.

The two latter groups in which no patient was permitted out of bed to void had an almost identical incidence of postoperative urinary retention. This would tend to offer further evidence that in these young men the medication was not an important factor. Furthermore the fact that the incidence remained so low in these two groups suggested that the sitting or erect position to void was not an essential factor in the improved results.

The final group observed included 208 patients to whom no medication was given. These patients were not permitted out of bed to void and were not catheterized for 24 hours unless definite distention was present. Ten patients in this group required catheterization, an incidence of 4.8 percent. Eight of these required catheterization on only one occasion, one patient on two occasions, and one required three catheterizations before normal bladder function was re-established. These patients received essentially the same treatment as those in group 1, in which the incidence of urinary retention was 21.6 percent, except that catheterization was not resorted to before 24 hours.

The reduction in the incidence of retention from 21.6 percent (group 1) to 4.8 percent (group 8) apparently resulted from permitting this

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24-hour rest period, and to the greatly increased experience of the ward personnel in handling the problem. The absence of cystitis in these latter groups was striking. The conclusion is that intelligent, sympathetic nursing care is the most important factor in reducing the incidence of postoperative urinary retention, which in young individuals is essentially psychic in origin.

SUMMARY AND CONCLUSIONS

Postoperative urinary retention in a series of 1,964 young men subjected to general surgical procedures in the abdomen, inguinal regions, perineum, and rectum was studied as to proper remedial measures.

The incidence of urinary retention in a group of patients treated by standard conservative methods for 18 hours after operation, without permitting the patient to stand to void, was 21.9 percent. Prostigmine in 1:2,000 solution given at 4-hour intervals for 8 doses, combined with conservative measures, permitting 24 hours to lapse before voiding, and allowing these patients to stand or be moved to the head when necessary, reduced the incidence of retention to 0.76 percent. Identical results were obtained when normal saline solution was substituted for the prostigmine.

The use of prostigmine in 1:2,000 solution at 4-hour intervals for 8 doses, permitting failure to void for a period of 24 hours but prohibiting the sitting or standing position, resulted in a 3-percent incidence of urinary retention. Identical results were also observed in a comparable series treated by the same method, with the exception that normal saline solution was substituted for the prostigmine.

In young men, free from organic urologic disease postoperative urinary retention is essentially psychic in origin. Intelligent, sympathetic and persistent nursing care is the most important single factor in reducing the incidence of postoperative urinary retention.

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THE SPHINCTER ANI INTERNUS

The *sphincter ani internus* (often described as the "internal sphincter") represents the inner circular muscle coat of the rectum which encircles the whole of the anal canal down to the anal intermuscular septum, *i. e.*, down to the tops of the subcutaneous portion of the external sphincter. Its lower border can be felt and identified just below the muco-cutaneous border of the anal canal, about one-fourth or one-half inch from the anal opening. It does not form a narrow annular band as is so often depicted and is not the important arbiter of continence.—DANIELS, E. A.: Ano-rectal suppurative disease and ano-rectal fistula. Canad. M. A. J. 50: 147–154, February 1944.

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RENO-URETERAL COLIC WITH HEMATURIA AT AN ADVANCE BASE HOSPITAL

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There has been an impressive number of patients with the diagnosis of renal colic, ureteral colic, and hematuria at this advance base hospital. Many of these were sent in with a positive diagnosis, but the majority were sent in with a diagnosis undetermined. Naturally most of these cases required complete urologic investigation. There were 27 cases of renal calculi, 19 cases of ureteral calculi, and 1 case of large bladder calculus. The remaining cases consisted of common urologic conditions with essentially negative findings.

In a large number of cases the chief complaint was reno-ureteral colic with hematuria. Many of the patients were seen in acute pain and with gross or microscopic hematuria. A cysto-urogram was done in each of these. During the first 2 months of 1942, 65 examinations of this type were made and only two cases of urinary calculi were revealed. Reports of examination consistently showed no shadow suggestive of calculus and no deviation from normal in the pyelo-ureterogram. These examinations so occupied the facilities of the x-ray department that they were interfering with its other activities. A more passive investigation of these cases is now used, consisting of a routine kidney, ureter and bladder examination, and repeated urinalyses. This passive attitude has been justified in that it has been learned that most of these patients under rest, forced fluids, and proper diet were promptly relieved of pain and the hematuria ceased. Considerable speculation exists regarding the etiologic factor productive of such a high incidence of reno-ureteral colic with hematuria in this vigorous youthful group. The following factors suggest themselves for consideration:

Dehydration.—All the patients came from areas having a typical tropical climate, high temperatures, and marked humidity. Under exercise these men perspired profusely. Drinking water was not always conveniently available. A daily fluid intake of 2,000 cc. may suffice in a temperate zone, but under the living conditions of these men a minimum of 4,000 cc. is necessary to maintain a normal water balance. Few obtained this requirement. Loss of weight was general. Urine became extremely concentrated and showed a high specific gravity. Heavy crystallization occurred.

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Diet.—The men were on a high-protein diet with a deficiency of green vegetables. This resulted in the formation and elimination of excess uric acid crystals. The urine consistently revealed the presence of uric acid crystals and urates. It is possible that showers of uric acid crystals passing down the ureter created an irritating influence and caused the renal colic and hematuria in many cases.

Deficiency in vitamins.—The diet of these men could be expected to be deficient in vitamins A and C. Fresh milk and fresh butter could not be supplied in this area, because of inadequate refrigeration. Citrus juices could not be adequately supplied; those which were available were reserved for the acutely ill. The deficiency of these vitamins must be considered.

Drugs.—The sulfa drugs as factors in explaining the existence of reno-ureteral colic with hematuria in these patients are excluded, as the history indicated no recent sulfonamide intake.

Subsequent results confirmed the validity of these observations, whereas adjustment of the proper water balance readily corrected the condition.

BACTERIAL FLORA OF WOUNDS

All war wounds and, in all probability, all accidental wounds are contaminated by bacteria by the time they are seen by a surgeon.

The bacterial flora of wounds is mixed and varied. Many different types of bacteria may be found contaminating wounds singly or in combination.

The bacteria fall into two main groups, an intestinal group and a pyogenic group. The sources of the former may be human or animal feces, soil, or clothing. The latter originates from the human sources such as the respiratory tract, skin, or other infected wounds.

Contamination by the pyogenic group seems to occur in a small proportion of cases at the time of injury, but in a much greater proportion after the time of injury. A considerable degree of secondary pyogenic contamination may occur by the time a surgeon sees a wound of three to six hours' duration. The importance of covering a wound immediately by the application of a sterile dressing is obvious.

The high degree of anaerobic bacterial contamination emphasizes the danger of closing extensive wounds, particularly compound fractures, unless careful and skillful débridement is possible. Even with apparently careful and time-consuming débridement, we have seen fulminating gas gangrene develop in civil practice in wounds that were closed. Early diagnosis of such anaerobic infections depends largely upon close observation of the wounded extremity, particularly when it is in a cast.—ALTEMEIER, W. A., and GIBBS, E. W.: Bacterial flora of fresh accidental wounds. Surg., Gynec. & Obst. 78: 164–168, February 1944.

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ORGANIC UPPER GASTRO-INTESTINAL DISEASE AT AN ADVANCE BASE

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Gastro-intestinal lesions, particularly duodenal ulcers, are said to be more common during wartime. To determine the incidence of organic gastro-intestinal disease in an advance base in the South Pacific area, the case histories and films of 200 consecutive patients who had x-ray examinations of the upper gastro-intestinal tract were reviewed. The purpose was to discover, if possible, any diagnostic aids which would economize time, effort, and materials, so that future x-ray examinations might be limited to those patients likely to yield positive findings, and to emphasize some of the problems encountered.

There was no selection of material inasmuch as there were no restrictions as to whether the history was typical of ulcer. Roentgenographic examination was made routinely if the referring medical officer thought an abdominal complaint necessitated eliminating the diagnosis of gastric or duodenal ulcer. All examinations were made within a 6-month period.

The x-ray examination was the usual combined fluoroscopic-roentgenographic one. It consisted of vertical and horizontal fluoroscopic examinations at various angles, with roentgenographic studies in the most advantageous positions. Routinely at least one vertical and one horizontal film were exposed. In those patients showing any deviation from normal, sufficient films were made for clear demonstration of the lesion. A 5-hour examination determined the progress of the barium meal. Additional roentgenographic or roentgenoscopic examinations were not made unless some abnormality was suggested.

Epigastric pain or distress was the most common chief complaint. No particular symptom pattern was noted. Complete histories were obtained in all but a few out-patients, and were classified as typical for ulcer if epigastric pain was present in relationship to meals, with relief by food or medication. Hematemesis alone was also considered a typical history, with or without pain. Any variation in this symptom complex was considered an atypical history.

Of the 200 patients, only 64 gave typical histories; but of the 22 patients with demonstrable ulcers, 16 had typical histories. This

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proportion was almost reversed in those who did not have organic disease; 129 among 135 had atypical histories.

Among 20 patients with ulcers, for whom there were complete histories, in 14 the symptoms had existed prior to enlistment. Among those without demonstrable organic disease, 41 of a total of 119 had symptoms previous to enlistment. Eighty of 124 patients with negative roentgenographic findings and 15 of 22 patients with ulcers had symptoms prior to foreign service. This indicates that service at home or abroad had little if any effect on the production of ulcer in the personnel studied.

Gastro-intestinal x-ray examinations were made of 7 patients in the hospital whose symptoms were of less than 1 month's duration, with negative findings in all. The duration of symptoms should probably be considered in evaluating the need for x-ray examination.

The results of previous x-ray examinations were known in 39 cases. 19 of which were negative for ulcer, 18 of the latter group being verified by the present examination. Of the remaining 20 with previously positive x-ray findings, only 6 were confirmed. In 3 instances studies had been made at Naval activities in this general region and in all 3 our findings confirmed those of the first examination. Evidently some reliance can be placed upon a history of negative x-ray findings.

Of the 22 patients with ulcers, 17 were above the age of 30 years. In the 5 ulcer patients under 30 years of age, 3 had typical ulcer histories. Of the 200 total examinations made, 101 were of patients less than 30 years of age; therefore this number probably represents a fair sampling to compare with the older group. If both the age group and the type of history are considered as criteria for ordering an x-ray examination, the accuracy of diagnosis will be high.

Negative x-ray findings may be of value in determining the disposition of patients. Among 99 admitted to the hospital, of whom we had records of discharge status, 45 with negative findings returned to duty. Fifty-four patients with negative findings were, however, transferred to the mainland for treatment and disposition. Analysis of this group showed that they were transferred with 28 different diagnoses, 25 of which were not related to gastro-intestinal tract pathologic changes. Two patients were returned with diagnoses of duodenal ulcer despite negative x-ray findings at this activity, and two with evidence of previous organic disease. One patient was returned with a diagnosis of pylorospasm, but the remaining 49, in addition to the two whose clinical diagnoses remained as duodenal ulcer, were transferred with diagnoses in which x-ray examination of the gastro-intestinal tract had been an unnecessary procedure.

Eighteen of 54 patients without demonstrable x-ray evidence of ulcer were transferred with diagnoses of some type of psychoneurosis. Al-

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though some of these may require an x-ray examination to rule out the diagnosis of ulcer, the majority show symptoms that make such examination unnecessary. If these patients are observed for a few days they usually present a multiplicity of symptoms in addition to local epigastric pain. Certainly if any psychoneurotic patients are to be transferred, regardless of other diagnoses, x-ray examination need not be done at an advance base.

At this hospital malaria and hookworm were encountered frequently. Both diseases are often characterized by abdominal complaints which may simulate ulcer. Roentgenographic examinations were made of two patients in the hospital with hookworm and one with malaria—all three yielding negative findings. A closer study would probably have led to a correct diagnosis without x-ray examination. The results of this survey seem to indicate that many x-ray examinations of the gastro-intestinal tract are done unnecessarily, particularly of patients whose history and symptoms should suggest diseases of a parasitic nature.

SUMMARY

1. Twenty-two patients with positive roentgenographic evidence of upper gastro-intestinal tract disease were found among 200 consecutive examinations at an advance base.

2. There were no indications that war conditions or foreign service had any effect upon the incidence of ulcer in this group.

3. The age group, type of history, and duration of symptoms should be considered before ordering an x-ray examination of the upper gastro-intestinal tract.

4. Patients at an advance base do not need roentgenographic examination for gastro-intestinal tract lesions if any other diagnosis requiring transfer to the United States is established concurrently.

5. The possibility of malaria, hookworm, or other parasitic infestation should be eliminated before ordering a gastro-intestinal roentgenographic examination.

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TREATMENT OF TROMBICULA IRRITANS (RED BUG) BITE

The Trombicula irritans (the common red bug, harvest mite, chigger) is distributed over most of the southern states and also is found in many tropical countries. It should not be confused with the sand flea which is also called the chigger in some localities. The parasite (Trombicula irritans) lives on weeds, grass and brush in the areas in which found. It has at times been quite a problem with troops in certain areas. It is picked up by the individual by clothing contact and the insect soon migrates to the skin, usually at some point on the lower extremities, the groin or genitals, the

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lower abdomen or at the belt line. However it may locate on areas of the body higher than the belt line. The lesion caused by this pest is indeed discomforting, producing a most intense and aggravating itch which persists for several days. When the insect locates and feeds, an area of inflammation is set up in the adjacent skin. The individual who has been bitten resorts to scratching in order to reduce the discomfort caused by the itch.

This article does not deal with the prophylaxis but with the actual treatment of the lesion after it has occurred. Various ointments, lotions, and baths have been recommended, all with only partial success. Perhaps the most common of the standard treatments are sulfur ointment, calamine lotion, starch baths, alcohol rubs, ether rubs and ointments containing cooling substance such as camphor or menthol. These agents do help some, it is true, but when one has been bitten the itching and discomfort, together with the scratching and danger of secondary infection, persist in spite of this treatment.

It has been found by the author from both personal use and by trial on many patients that there is one treatment which is immediately and almost completely successful. This treatment consists in painting each lesion with a good coating of collodion or fingernail polish. The fingernail polish may be obtained at any drug or variety store and the collodion may usually be obtained at many medical activities.

The collodion or fingernail polish forms a thin film over the affected area which cuts off the supply of air and causes the death of the parasite. At the same time it prevents clothing and other articles from touching the lesion and this produces a decrease in itching. It is quite necessary to instruct the patient absolutely not to scratch the treated area because with this treatment when there is no scratching, there is very little itching. Scratching causes the itching to begin again.—FOWLER, C. D., Lieutenant (MC) U. S. N. R.

VITAMIN C EFFECT IN SYPHILIS

The spirocheticidal effect of bismuth and the trypanosomicidal effect of antimony are enhanced by vitamin C, which seems to influence the capacity of these organisms to take up the metals. The action of arsenic and gold, too, seems favored in the presence of this vitamin. * * * The author reports that seven of ten luetics studied changed from a Wassermann-fast positive condition to a Wassermann negative condition through the use of bismuth cevitamate. Thus, ascorbic (cevitamic) acid seems to hold an important key to the solution of the problem of Wassermann-fastness.—RUSKIN, S. L.: Influence of vitamin C on Wassermann-fastness in syphilis. Am. J. Digest. Dis. 10: 170–174, May 1943.

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OBSERVATIONS ON BACTERIOLOGY AND EPIDEMIOLOGY OF ACUTE RESPIRATORY TRACT INFECTIONS IN THE TROPICS

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During a recent tour of duty on board a hospital ship in the Southwest Pacific, it was impressive to note the amount of morbidity caused by acute infections of the respiratory tract, and the rarity of the pneumococcus on routine cultures of the nasopharynx. For several months the ship was engaged in evacuating casualties from a combat area to cities in a temperate climate. The incidence of respiratory tract infections among these patients was low. But outbreaks of colds, catarrhal fever, and tonsillitis among our own crew occurred after almost every trip to these urban communities. At other times the ship was stationed in tropical ports where acute respiratory tract infections were infrequent. Patients with these infections were continually being admitted from other activities. More of these came from ships having had direct contact with ports in temperate climates, or having indirect contact with them through drafts of newly arrived personnel, than from shore establishments.

Under normal conditions respiratory tract infections in the tropics are unquestionably less of a problem than in temperate climates. This is due in part to warm temperatures, which are evidently unfavorable for the propagation of virulent strains of bacteria and viruses. In these islands the native and white populations are sparse and have few contacts with other communities and outside sources of infection.

In the present war, however, great numbers of military personnel are continually being transported between these areas and the thickly populated regions of New Zealand, Australia, and the United States. Since transportation is now so rapid, newly arrived men from the temperate zones may still carry virulent strains of bacteria and viruses which can readily be transmitted to others. This is a particular danger on shipboard where living accommodations are

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crowded and where the arrival of new men is frequent; furthermore, many ships make frequent trips to and from cities in the temperate zone where opportunities for personnel to reacquire virulent organisms are numerous. These men can in turn act as sources of infection for the more stable military population in the tropics. It has been observed that the incidence of acute respiratory tract infections among our armed forces in this area is greater than that anticipated from peacetime experience.

Inasmuch as this group of infections constitutes a military problem in the Southwest Pacific, it is important to determine whether the normal bacterial flora of the nasopharnyx differs significantly from that in the United States and whether the incidence of specific bacteria bears any relationship to certain types of respiratory tract disease.

MATERIAL AND METHODS

During the year of 1 July 1942 to 1 July 1943, there were 8,820 patients admitted to the sick list aboard this ship and 265 readmissions; thus there were 9,085 different admissions. Two hundred seventy-two cultures were made from the nasopharynx, representing 231 different cases, 70 of which represented out-patients. Of these cultures, 208 were from the throat, 45 were of the sputum, 15 were from the nose, and 4 were from the mouth.

The material for culture was routinely "sun-burst" on human blood agar plates, and tryptose-phosphate broth and frequently Loeffler's medium were inoculated. Original smears were always made. If the patient was thought to have pneumonia, direct typing of the sputum was attempted by the usual Neufeld method with type-specific immune rabbit serum. At the end of 24 and 48 hours, the cultures were examined and smears made. All different types of colonies on the blood agar plates were examined individually and were subcultured when indicated.

Facilities were not available, however, for the complete differential examination of all different bacteria. Routinely, for example, no attempt was made to differentiate individual species of hemophilus, micrococci, or streptococci. Immune sera were not available for the typing of beta-hemolytic streptococci, likewise no further identification was attempted of colonies characteristic of nonhemolytic streptococci which on smear were gram-positive cocci. Gram positive cocci were reported as alpha-hemolytic streptococci, when the colonies had a distinctive zone of alpha hemolysis, when they were small, gray, opaque, and conical, when they gave a flocculent growth in broth, and when they did not ferment inulin, or were not bile-soluble. On the other hand alpha-hemolytic colonies which were flat, especially if the colonies themselves were slightly green or brown,

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were inoculated from fresh broth cultures into mice. Even if they could not be typed directly from the sputum or after mouse inoculation, they were reported as pneumococci if the growth in broth was uniformly turbid and if the organisms were bile-soluble and fermented inulin.

The identification of other organisms needs no further comment. Although these methods are not wholly satisfactory, the classification of the organisms appears to be sufficiently accurate to determine the incidence of groups and genera of bacteria.

RESULTS OF CULTURES

In table 1 is shown the total number of times various bacteria have been isolated without regard to the character of infection. Only about one-half of these cultures, however, were taken from patients having strictly acute infections. The remainder were taken from such cases as chronic tonsillitis, chronic bronchitis, asthma, pulmonary tuberculosis, serofibrinous pleurisy, diphtheria (during convalescence), and chronic sinusitis. It is assumed, therefore, that the proportionate numbers of individual bacteria represent the relative incidence of these organisms in any similar group of cases in this area. It will be seen that Staphylococcus albus and nonhemolytic streptococcus occurred most frequently and in equal numbers. Alpha-hemolytic streptococcus and beta-hemolytic streptococcus were third and fourth respectively. The remaining organisms were less numerous than the first three and pneumococci were isolated only seven times.

TABLE 1.—*Totals of all cultures*

Staphylococcus albus	182	Diphtheroid	33
Nonhemolytic streptococcus	180	Hemophilus	14
Alpha-hemolytic streptococcus	108	Pneumococcus	7
Beta-hemolytic streptococcus	77	Corynebacterium diphtheriae	1
Micrococcus	58	Miscellaneous	9
Staphylococcus aureus	49	Vincent's organisms	41

The most common acute infections are grouped as catarrhal fever, acute tonsillitis, and pneumonia. The patients selected for these groups were all hospital admissions, so that it is certain from the clinical course that the diagnosis was correct. If any of the organisms had an especial etiologic relationship to these infections, they should occur more frequently when the cultures are similarly grouped than when all cultures are taken together.

In table 2 are given the results of 32 cases of acute catarrhal fever. Some have more than one culture. It is evident that the ratios of the more common bacteria are almost identical with those in the group as a whole; however, in 36 cases of acute tonsillitis, represented in table 3, the relative incidence of alpha-hemolytic streptococcus is less than the

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general average and the occurrence of beta-hemolytic streptococcus is roughly twice the expected incidence. But in table 4, representing 16 cases of pneumonia proved by chest x-rays, the relative incidence of bacteria shows no significant departure from the group as a whole. Most of these bacteria were obtained from sputum cultures. In only two cases were pneumococci isolated. One could not be typed; the other was Type III, the only pneumococcus during the entire period which could be typed; furthermore, in only seven cases of the entire group were pneumococci identified on culture.

TABLE 2.—*Totals of 32 cases of acute catarrhal fever*

Staphylococcus albus	26	Staphylococcus aureus	10
Nonhemolytic streptococcus	22	Diphtheroid	6
Alpha-hemolytic streptococcus	18	Hemophilus	2
Beta-hemolytic streptococcus	10	Pneumococcus	0
Micrococcus	11	Vincent's organisms	0

Vincent's organisms were found in the original smear seven times in cases of acute tonsillitis, but were not found in any cases of catarrhal fever or pneumonia; however, they occurred forty-one times in the group as a whole, most frequently in out-patients having acute or chronic tonsillitis. Cases of Vincent's infection of the gingiva are not included in this group.

COMMENTS

Considering the totals of all cultures, it is believed that the four most commonly isolated organisms, Staphylococcus albus, nonhemolytic streptococcus, alpha-hemolytic streptococcus, and beta-hemolytic streptococcus, have an incidence which is not significantly different from that in the United States. Micrococci and diphtheroids, however, appear to be less common. The latter two are not generally causes of infection in temperate climates, but the first four frequently are secondary invaders and may be responsible for lengthened convalescence from acute infections of other etiology. Although micrococci and Staphylococcus aureus appear to be relatively more common in the catarrhal fever group than in the others, it has been observed that patients in this area with colds and catarrhal fever less frequently have persistent purulent discharges from the nasopharynx and bronchi than they do in the United States.

TABLE 3.—*Totals of 36 cases of acute tonsillitis*

Staphylococcus albus	27	Staphylococcus aureus	6
Nonhemolytic streptococcus	29	Diphtheroid	7
Alpha-hemolytic streptococcus	7	Hemophilus	5
Beta-hemolytic streptococcus	22	Pneumococcus	0
Micrococcus	11	Vincent's organisms	7

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On the other hand, although the incidence of beta-hemolytic streptococcus is not unusual for the group as a whole, its relatively greater frequency in cases of acute tonsillitis signifies that this organism is probably responsible for many of the infections; consequently it is the only one of the more common organisms in the group which is shown to have etiologic significance. It is believed, however, that smooth variants of other bacteria, particularly nonhemolytic and alpha-hemolytic streptococci, were responsible for many acute infections. The most striking difference from temperate climates is the rarity of the pneumococcus. In the continental United States the incidence in routine cultures from the nasopharnyx is often as great as 40 percent. Whether the pneumococcus can mutate to the alpha-hemolytic streptococcus is not within the province of this article, but the frequency with which the latter organism is isolated makes this hypothesis attractive. At any rate, it is evident that the pneumococcus cannot survive for long periods in the tropics.

The frequency of acute respiratory tract infections among our armed forces in the Southwest Pacific is of military importance. As in the United States, the common cold and catarrhal fever are the most numerous and most often are caused by a group of viruses. During this period 122 cases of catarrhal fever were admitted to this ship; of these, 72 were members of our own crew. These cases include only those patients who were febrile and ill enough to be put to bed. Among our crew, cases of the common cold not severe enough for bed treatment were even greater in number. Of the 72 crew members, 50 were admitted immediately following trips to evacuation ports where the climate was temperate and the civilian population large. Many of the remainder may well have acquired their infections indirectly from these areas by exposure to other members of the crew having similar infections. The remaining 50 cases were from shore activities in the tropics or from ships having touched at home ports at varying intervals. The epidemiologic significance of these cases is in doubt, because most medical activities were able to care for their own cases of catarrhal fever, and we have insufficient data as to incidence and place of exposure. But the mild outbreaks of catarrhal fever and colds among our own crew after contact with inhabitants of temperate climates was so consistent as substantially to increase the amount of morbidity. At other times, when the ship remained for long periods in tropical waters, acute respiratory tract infections virtually disappeared.

Although similar conditions would undoubtedly exist among troops in the field if they were segregated, the continuous arrival of personel from temperate areas exposes them repeatedly to new sources of infection. The morbidity rate, consequently, must be substantially higher than would otherwise occur; furthermore, in the case of those

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who have escaped exposure for long periods, their immunity is so lowered that upon their return to the United States or other temperate zones, bouts of respiratory tract infections are to be expected.

Forty-three patients with acute tonsillitis were admitted to this ship. As previously stated, 36 of these had throat cultures. Although the frequency of acute tonsillitis is undoubtedly less than in cooler climates, the beta-hemolytic streptococcus and other pathogenic bacteria must be able to survive in the torrid zone, probably in the tonsillar crypts, and be capable of renewed virulence under proper conditions. It is likely that most of these attacks represented acute exacerbations in chronically diseased tonsils. It was found advisable to remove the tonsils in many of the patients following subsidence of the acute infection. In the intervals when the ship was not evacuating casualties, 108 patients were admitted for tonsillectomy with a diagnosis of chronic tonsillitis. Nearly all of these, likewise, gave histories of repeated attacks of sore throat. In the crowded conditions aboard ship they were a menace not only to themselves but also to others with whom they came in contact.

In addition, 18 cases of acute otitis media and 37 of sinusitis were admitted to this ship. Although most of the former were undoubtedly secondary to acute infections of the upper respiratory tract, many of the latter were exacerbations of chronic infections. Their epidemiologic significance is minor by comparison with those of catarrhal fever and tonsillitis; but their number suggests that even in the tropics patients are by no means immune to the complications of respiratory infections which are so common in the United States.

The rarity of pneumococci in the nasopharynx suggests that cases of pneumonia should be equally uncommon. That this is not necessarily the case is shown by the fact that 16 patients were admitted who were still sufficiently ill for cultures to be taken. An additional eight patients were admitted who were well along in convalescence and in whom cultures were not taken. Only those cases are included in which there was confirmation by x-ray and the subsequent clinical course. Of these 24 cases, 17 were lobar and 7 were lobular. Although the date of onset was uncertain in some instances, the duration of fever varied between 2 and 25 days. Some complication, such as empyema, was responsible for the prolonged course in all in which fever lasted more than 10 days. One patient developed a lung abscess following subsidence of the pneumonia, which was preceded by an immersion blast injury. Another had multiple foci of consolidation, and a pure culture of Staphylococcus aureus was obtained from the sputum. Although in only one patient was a type-specific pneumococcus isolated, the clinical course, in the cases of lobar pneumonia at least, was generally similar to that of pneumococcic infections and

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not of severe virus pneumonia as it is known in the United States. However in two of our patients having short mild febrile courses, sulfonamides were not given; nevertheless there were large areas of consolidation by x-ray which were limited to one lobe. It is possible, therefore, that some of the cases were caused by viruses or by other bacteria. On the other hand the failure to isolate pneumococci more often is not surprising, because in the remaining cases sulfonamides were given before admission to this ship.

TABLE 4.—*Totals of 16 cases of pneumonia*

Staphylococcus albus	15	Staphylococcus aureus	3
Nonhemolytic streptococcus	17	Diphtheroid	0
Alpha-hemolytic streptococcus	12	Hemophilus	1
Beta-hemolytic streptococcus	3	Pneumococcus	2
Micrococcus	5	Vincent's organisms	0

Inasmuch as pneumococci are so uncommon in this area, the question arises as to how these patients acquired the infection. For purposes of discussion it is assumed that with the exception of the case of staphylococcic pneumonia most of them were caused by the pneumococcus. Of the 23 remaining patients, 4 acquired infections on transports shortly after leaving the United States. Five cases followed severe wounds or shipwreck; 7 occurred on combat ships; 5 on shore stations in combat areas; and 3 on shore stations in noncombat areas. It is evident that those having just left the United States either harbored the pneumococcus themselves or were in contact with men who did. As for the remainder, it is not known from the histories how recently the patients had left populous communities in the temperate zone, but during this period both on ships and shore stations men were constantly arriving from the United States, often in large bodies. It is likely therefore that 2 groups are susceptible to pneumococci in this area, especially when resistance to infection is lowered by fatigue, exposure, wounds, or intercurrent disease, i. e., those who still harbor the pneumococci in the nasopharynx and those who have lost immunity to the organisms after several months in the tropics and who come in contact with carriers of the pneumococcus.

SUMMARY AND CONCLUSIONS

1. On board a hospital ship in the Southwest Pacific from 1 July 1942 to 1 July 1943, 272 bacteriologic cultures from sputum and nasopharynx were examined.

2. Staphylococcus albus and nonhemolytic streptococcus were isolated most frequently. Alpha-hemolytic streptococcus and beta-hemolytic streptococcus respectively were next in frequency.

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3. The occurrence of the most common organisms is not significantly different from that in the United States, but micrococci and diphtheroids were found less frequently than in temperate climates.

4. Beta-hemolytic streptococcus was found more often in acute and chronic tonsillitis than in any other disease and was the only one of the common organisms that consistently had an etiologic role.

5. Pneumococci are rare and were isolated in only seven instances.

6. Lobar and lobular pneumonia occur more frequently in this area than the rarity of pneumococci would indicate; the etiology and sources of infection are discussed.

7. Because of the continual arrival of large numbers of military personnel from the temperate zones, acute respiratory tract infections in the tropical islands of the Southwest Pacific are common and are an important military problem.

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THE ANO-RECTAL RING

The *ano-rectal ring* is the muscle structure of prime importance guarding continence. The subcutaneous and superficial portions of the external sphincter, part of the internal sphincter, and any of the structures up to this ring, may be cut or sacrificed with impunity, and yet continence will be preserved. Continence is only lost with the sacrifice during surgical operations of this important muscle band. The ano-rectal ring is a composite fibromuscular band composed of: (a) The upper portion of the internal sphincter; (b) the longitudinal muscle fibres at this level of the rectum; (c) the puborectalis part of the levator ani posteriorly; and (d) the external sphincter ani profundus muscle. An important consideration in the treatment to be shortly outlined is the difference of the levels between the posterior and anterior parts of the ano-rectal ring. Posteriorly this ring lies at an approximate distance of two inches from the anal opening, roughly the second crease on the volar aspect of the index finger, anteriorly the distance from the anal opening is approximately one inch, roughly the first skin crease on the volar aspect of the index finger.

In other words, the ano-rectal ring anteriorly lies in a lower plane than the ano-rectal ring posteriorly. The ano-rectal ring slopes downwards from the posterior aspect as an inclined plane to the anterior part of the ano-rectal circumference, and lies at its lowest level at the anterior ano-rectum. This difference in levels is approximately one inch. This is an important consideration in operations upon ano-rectal fistulae, because posteriorly one can sacrifice muscle tissue with more impunity than one can anteriorly. The ano-rectal ring is thus the final and important arbiter as far as continence is concerned.—DANIELS, E. A.: Ano-rectal suppurative disease and ano-rectal fistula. Canad. M. A. J., 50: 147–154, February 1944.

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PRESENT STATUS OF PENICILLIN

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Although factors inhibiting bacteria have been known for 5 decades, only during the past several years has the general interest of the medical profession been aroused on the subject of the antagonistic relations of microorganisms. This enthusiasm reflected itself in a vast literature concerning antibiotics. Recent reviews (*1*) (*2*) on penicillin alone list over 100 articles. The purpose of this commentary is to summarize succinctly up to the present date the knowledge and data concerning this most important antibiotic.

Fleming (*3*) was the first to observe that the growth of certain bacteria upon agar was suppressed following the chance introduction of a mold. Such an accident was not unusual, because the genus to which this mold belonged was so widespread that it constituted the common conception of "mold."

To the time of this discovery, the only known usefulness of this group of molds was the ripening effect upon Camembert and Roquefort cheeses (*4*). Indeed, even after this revelation, the utilization of the agent seemed to be confined to the laboratory, where it was used to separate bacteria or to demonstrate natural bacterial hostility (*5*) (*6*). During the progress of these expositions, the mold was identified as Penicillium notatum Westling, and the agent it produced which was noxious to bacteria was called penicillin.

With the exception of the finding by Clutterbuck, Lovell, and Raistrick (*7*) that the mold grew on both organic and inorganic media, and Reid's (*8*) investigations confirming the fact that only Fleming's species of Penicillia had any antibacterial effect, matters rested until 1940. In 1940–41 Florey, Abraham, and Chain (*9*) (*10*) first published reports of their research in this field. Their communications were so optimistic that a great number of investigators have become interested with a result that many facts not previously known are now part of common knowledge.

The mold.—The mold grew on a variety of media but Clutterbuck's modification of the synthetic Czapek-Dox media gave the best results:

	Gm. or cc.
Sodium nitrate	3.0
Potassium acid phosphate	1.0
Potassium chloride	0.5
Magnesium sulfate	0.5
Ferrous sulfate	0.01
Glucose	40.0
Distilled water q. s. ad	100.0

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The substitution of brown sugar for glucose, as McKee and Rake (*11*) suggested, greatly improved the growth, but other modifications made by Hobby et al. (*12*), Foster, Woodruff and McDaniel (*13*), Kocholaty (*14*), and Challinor (*15*) were of some value.

Only known identified strains of P. notatum of the highest potency were selected and these carefully controlled to prevent degeneration (*13*). Usually the mold was allowed to sporulate on a slope of Sabouraud's medium from which a spore suspension was prepared by shaking with sterile water. This mixture, sown in sterile shallow media gave rise in 24 hours to a fluffy growth on the bottom of the vessel. The germinating fungus reached the top of the solution on the 3d day, and within a week the compact greenish wrinkled felt covered the entire surface. Later the green color faded to gray. During this period of growth, the substrate gradually turned yellow from the formation of a pigment, chrysogenin, which had no antibacterial action. However, penicillin of high assay value was rarely found in the absence of this coloring matter.

The mold flourished at 22° C. and failed to grow at 37° C. Growth did not occur anaerobically.

The method of growing the mold on shallow media sketched above is of historic interest, but now almost all manufacturers use a modification of the technic described by Clifton (*17*) for the large-scale production of penicillin. He constructed a tube containing a column of wood 4½ feet long. The top of the apparatus contained two holes: One for the passage of the Czapek-Dox culture medium and the other for the admission of a stream of air. After sterilization by steam, the shavings were wetted with culture medium, and P. notatum inoculated. The culture medium flowed at a rate of 800 ml. daily, and was later extracted in the manner described below.

The production of penicillin was in part dependent upon the reaction of the media (*9*) (*10*) (*13*) (*16*). At the beginning, the neutral reacting medium slowly became acid (pH 3) by the end of the 3d day, rose to pH 5–6 by the time of the appearance of the green color of the mold, and as the color of the mycelium faded, changed to alkaline (pH 8). The production of penicillin was maximum near the neutral point (*13*).

A yield of 2 to 4 (rarely 6 to 8) units per cc. of culture fluid was considered good. The time required for the mold to produce this assay value of penicillin was between 10 and 15 days, although McKee and Rake found that this period could be reduced to 6 days by replacing used media with fresh.

Purification, properties, and assay.—Although a small amount of penicillin was found in the thallus (*16*) the greater part was obtained from the substrate.

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The difficult extraction of penicillin from the culture media was best described by Abraham and Chain (*10*) (*19*). The method consisted of dissolving the acidified, filtered, crude substrate in an organic solvent at a low pH (2), followed by its being dissolved in an aqueous diluent at another level (pH 6–7). Multiple repetitions of this procedure removed some of the foreign material, and more was eliminated by treatment with animal charcoal. The partially purified mixture, when chromatographed upon an alumina column, separated into four distinct fractions of which only the yellow second portion, containing the bulk of the penicillin, was treated with organic solvents as before. After another passage through the alumina column, the second section was reduced with aluminum amalgam, and extracted with amyl acetate. Three successive chromatographs upon the alumina column, elution with phosphate buffer, extraction with amyl acetate and finally removal from the acetate solution by barium hydroxide completed the purification. From the last solution, the yellow barium salt of penicillin was obtained by drying by the lyophilic method.

Penicillin has been obtained as the free acid, and the salts of barium, potassium, sodium, ammonium, calcium, and strontium. All are hygroscopic, and rapidly lose their activity upon exposure to air. Both the acid and salts are soluble in both organic and aqueous dissolvents. Penicillin withstands heating for 1 hour at 56° C., but autoclaving it for 15 minutes at 115° C. completely destroys it.

An empirical formula has been suggested by Abraham and Chain (*19*) (*20*) as $C_{24}H_{32}O_{10}N_2Ba$ (M. W. 640–645) or $C_{23}H_{30}O_9N_2Ba$. These formulae are essentially in agreement with that suggested by Catch, Cook, and Heilbron (*21*). A structural formula has not been postulated.

Assay.—A completely satisfactory technic of assay is not available. A need for its establishment is to ascertain the particular antibacterial titer of a culture's substrate.

The two most frequently used methods include modifications of the Oxford cup and the serial dilution plans. In the former, tiny glass vessels containing penicillin are implanted in nutrient agar heavily seeded with Staphylococcus aureus (*10*). The plates are incubated for 12 to 16 hours at 37° C., and the zone of bacterial inhibition surrounding the cylinders is noted. A standard solution produces an average zone of inhibition of 24 mm.; this has been defined as a Florey (Oxford) unit.

The serial dilution procedure is completed upon agar plates implanted with staphylococci or in broth cultures of hemolytic streptococci. To the latter erythrocytes are added as an indicator. After preparation of the materials a standard solution, known to contain a

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certain quantity of penicillin, and the unknown are respectively serially diluted in the agar or broth, and incubated for 24 hours. The tubes are assayed for hemolysis or the plates studied for bacterial inhibition. From a comparison of the end-points in the standard and unknown series, the strength of the latter may be calculated.

Obviously the first definition of the Oxford unit does not apply for the serial dilution method. The unit defined in terms of serial dilution is that amount of penicillin which, when dissolved in 50 cc. of meat extract broth, completely inhibits the growth of a test strain of S. aureus. Expressed differently, the meat extract broth which contains one unit per milligram just inhibits the growth of S. aureus in a dilution of 1 : 50,000.

Because of ease of performance, the serial dilution method in broth is the method of choice.

Related substances.—The most important is notatin, which may be identical with two other products called penicillin B and penatin. Foster, Woodruff and McDaniel (*13*), consider penicillin B of Roberts, Van Bruggen and others (*22*). (*23*), penatin of Kocholaty (*14*) (*24*) and notatin of Coulthard et al. (*25*) as identical substances. Its formation probably is dependent upon the pH of the media. Normally using impure materials containing traces of heavy metals (zinc, copper, manganese) or organic supplements (yeast extract), the pH undergoes the variations described above. However, extremely pure ingredients cause no secondary rise in the low pH (3 to 4). It is in this depressed range that notatin is formed, which accounts for its frequent presence in many normal cultures of P. notatum, even when the typical late rise in pH occurs. In a word, notatin is formed in acid media, while penicillin is produced in almost neutral media.

Notatin, an aerodehydrogenase, exerts its activitiy only in the presence of oxygen and glucose, and in the absence of appreciable amounts of catalase. The great importance of notatin is that it inhibits not only the growth of gram-positive organisms, but also of some gram-negative bacteria (Eberthella typhosa and paratyphosa, Vibrio cholerae).

Other substances isolated from cultures of Penicillium notatum or penicillin include penicidin of Atkinson (*26*) (*27*), penillic acid of Duffin and Smith (*28*) and pencillamine of Abraham, Chain, et al. (*29*). The exact place of these substances in the design is undecided.

Antibacterial actions.—Fleming noted that penicillin acted best against pyogenic cocci and the diphtheria group of bacilli, but that gram-negative bacilli were insusceptible. Since then many lists of organisms against which penicillin is active or inactive have been compiled, but the register frequently referred to is the one of Hobby.

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Meyer, Dawson, and Chaffee (*12*) (*30*) which tabulates the sensitive and insensitive organisms:

Susceptible	*Insusceptible*
Pneumococcus	Haemophilus influenzae
Streptococcus hemolyticus	Escherichia coli
Staphylococcus	Bacillus typhosus
Meningococcus	Bacillus dysenteriae
Gonoccocus	Bacillus proteus
Streptococcus viridans	Bacillus paratyphosus A
Bacillus subtilis	Bacillus enteritidis
Clostridium welchii	Bacillus pyocyaneus
Vibrion septique	Bacillus fluorescens
Clostridium histolyticus	Bacillus prodigiosus
Bacillus sporogenes	Friedländer's bacillus
Bacillus oedematiens	Staphylococcus albus—1 strain
Bacillus sordellii	Micrococcus albus—1 strain
Lactobacillus	Monilia albicans
Cryptococcus hominis	Monilia kruzei
	Monilia candida

The Mycobacterium tuberculosis is resistant; certain strains of Actinomycosis bovis are susceptible (*31*) (*32*).

The question as to why certain organisms are susceptible while others are not intrigued Abraham and Chain (*33*). They ascertained that an extract of Escherichia coli eradicated the growth-inhibiting properties of penicillin upon Staphylococcus aureus. This substance, penicillinase, apparently an enzyme, was found by Harper (*34*) to be more abundant in extracts of the paracolon bacillus. Probably the presence of this enzyme may determine whether an organism is normally resistant to penicillin. However certain organisms, pneumococcus (*18*) (*35*) and staphylococcus (*36*) (*37*) were induced to develop resistance by growing them either in vitro or in vivo in the presence of sublethal doses of penicillin. The exact mechanism of this is unknown, for penicillinase is not formed.

Mechanism of action.—Penicillin is bacteriostatic (*9*) (*10*) but may be bactericidal under certain conditions (*30*) (*31*) (*38*); even if sterilization does not occur, there is always a marked reduction in the number of organisms (*12*).

Penicillin acts like no other therapeutic agent in that it is not a detergent, not hemolytic, and is unaffected by the presence of pus, products of tissue destruction, or large numbers of bacteria (*39*). Erythrocytes and plasma do not inhibit its action (*40*).

Since penicillin is most effective when multiplication of bacteria takes place, the action of the drug may be on bacterial fission, rather than on the metabolism and growth of the individual organisms (*41*). No detectable amount of penicillin is absorbed or destroyed by the bacteria. Except in the case of staphylococci, lysis of organisms does not occur, although there is spherical enlargement of cells, incomplete fission, and in the case of the streptococcus increased length of chains (*42*).

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Comparison of sulfonamides with penicillin.—Resistance to sulfonamides does not indicate recalcitrancy to penicillin (*43*) (*44*) (*45*). Resistance to penicillin is acquired with difficulty, resistance to sulfonamides much more readily. Investigations comparing the strength of sulfonamide drugs and penicillin led Fleming (*39*) and Powell and Jamieson (*46*) to come to the conclusion that penicillin is at least twice as effective against staphylococci and streptococci as are sulfonamide drugs. The situation has been summarized by Abraham et al. (*10*) who stated that penicillin had the following advantages over sulfonamides:

1. It is influenced only slightly by the number of bacteria to be inhibited.
2. It is not antagonized by hydrolytic break-down products or pus.
3. It combines low toxicity to cells with powerful bacteriostatic action.
4. Its action is stronger.

Absorption.—The bitter-tasting drug is inactivated by the hydrochloric acid (not the pepsin) of the stomach. Even when the stomach is by-passed by enteric-coated capsules or a duodenal tube, the drug is absorbed irregularly from the intestinal mucosa. Administration by rectum is precluded because of the inhibitory action of Escherichia coli.

The drug is slowly absorbed after subcutaneous injection, and there is a long delay before it appears in the blood. The concentration does not reach the levels attained when it is given intravenously or intramuscularly. Intermittent intramuscular injections cause a rapid rise in the blood level, but not to the same heights as the intravenous route. With the latter technic, there is a rapid rise in the serum level followed by a rapid fall. The absorption following introduction into body cavities is similar to the subcutaneous route (*40*).

Penicillin may be injected intrathecally without harm (*9*) (*47*). Indeed since penicillin is not passed through the meninges from the blood, its administration directly into the subarachnoid or cisternal spaces is the only feasible method in meningeal infections.

Penicillin in the blood.—The degree of antibacterial action is proportional to the concentration of penicillin in the serum. Rammelkamp and Keefer (*48*) found that to attain bacteriostatic effects against hemolytic streptococci, a concentration of 0.019 to 0.156 units per cc. of serum was required. A higher concentration (0.156 Florey units) was necessary against S. aureus. Suitable bacteriostatic levels are maintained better by the frequent injection of small amounts of penicillin than by larger portions at less frequent intervals (*30*).

The effect of penicillin upon the leukocytes is most important, for in almost all cases the ultimate destruction of bacteria depends upon

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them. While strong concentrations of the drug (1:250) inactivate white blood cells in vitro, it is unlikely that in concentrations reached therapeutically, leukocytes are affected.

Excretion.—Some penicillin is destroyed in the body (*49*), possibly in the liver, but the precise location is unknown. However a good proportion (50 percent) is excreted unchanged in the urine, usually within 1 hour after administration. Renal failure delays the excretion of the drug with a consequent increase in concentration in the blood.

Toxic reactions.—There have been no deaths reported from the use of penicillin in man.

Almost all reactions are considered to be caused by adulterants, and as purification of the drug continues, the number of reactions becomes less (*50*). It is possible that many of the reactions listed by Lyons (*51*) as caused by impurities will shortly disappear. These are:

1. Chills with or without fever after intravenous injection.
2. Eosinophilia—20 to 30 percent.
3. Burning pain at site of intramuscular injection.
4. Headache.
5. Faintness and flushing of face.
6. Unpleasant taste following parenteral injection.
7. Tingling in testes.
8. Muscle cramps.
9. Femoral phlebothrombosis.

The same author states that some of the toxic reactions are caused by the drug itself, i. e.:

1. Urticaria. This is common and occurred in 5 percent of his cases. The rash remains for 3 to 5 days, and is benefited by epinephrine. Fever to 103° F., eosinophilia, and abdominal cramps are frequent concomitants. Although it is believed to be an allergic manifestation, sensitivity tests are negative.
2. Fever in afebrile patients.
3. Transient azotemia—to 35 mg. per 100 cc. of blood.
4. Thrombophlebitis.

Administration.—Penicillin is available in vacuum-packed ampules of 5,000, 10,000, 25,000, 100,000, and 1,000,000 units (*53*). The drug is soluble in normal saline solution, distilled water, and 5-percent dextrose. Any one or a combination of these may be used as a vehicle.

The oral administration by means of enteric-coated capsules or duodenal tube is not practicable. A choice of a parenteral route is necessary and a summary of the methods now used follows:

1. Continuous intravenous.—For almost all infections, particularly severe generalized ones, this is the method of choice (*31*) (*43*) (*50*). The drug is dissolved in the selected vehicle at a concentration of 50

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to 100 units per cc. A needle is inserted into the chosen vein, anchored securely, but changed daily to prevent thrombosis. Except during the patient's sleep or delirium, the extremity need not be confined. Approximately half the daily dose is connected to the intravenous apparatus morning and evening. The first 200 cc. of the solution is given rapidly, after which the rate of flow is reduced to 30 to 40 drops per minute. If there is any interval between the attachments of the penicillin solutions, glucose or saline may be substituted, thus eliminating the necessity of removing the needle. This method is without major discomfort to the patient and conserves the time of the medical personnel.

2. Intermittent intravenous.—A calculated dose (1,000 to 5,000 units per cc. of fluid) is administered by syringe as often as necessary—usually every 3 hours.

3. Intramuscular.—In unskilled hands the intramuscular injection into the gluteus maximus or deltoid muscle is the best (*51*) (*52*). The same concentration of drug is used as in 2. Some of the residual soreness remaining after injection may be eliminated by the use of saline solution instead of distilled water as the diluent (*40*).

4. Topical.—Since penicillin is excreted rapidly and diffuses poorly, it is used locally in pleural and joint infections, wounds, etc. This is in addition to the other parenteral routes listed above.

The powder or penicillin in high concentrations is not used, because of its irritating properties (*32*) (*53*). The solution of choice is isotonic saline containing 250 units per cc. This may be used as a spray, applied locally by means of gauze dipped into it, or injected directly into a body cavity. This solution may be used without harm in the accessory nasal sinuses or middle ear (*54*).

A cream for burns has been recently suggested (*55*). It is prepared as follows:

Heat 50 gm. of Lanette wax and 120 cc. of castor oil to 70° C. until the wax is melted. Add, gently stirring to avoid aeration, 275 cc. of sterile water heated to 60° C. The resulting cream is stable and neutral.

Dissolve penicillin in sterile distilled water in such a quantity that 1 cc. contains 800 units. Add 5 cc. of this to 30 gm. of base. The final strength is 120 units per gram.

5. Intrathecal.—The exact concentration and quantity of the solution to be given intraspinally has not been established. However, 10,000 units (5,000 units per cc. of saline) has been injected twice daily without harm (*50*).

Bloomfield pointed out that the management of penicillin therapy is best vested in a team consisting of an especially-equipped group of physicians aided by necessary technical personnel. This team evalu-

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ates the condition of the patient, and prescribes the dosage of penicillin. The preparation and injection of the drug—together with the responsibility for the keeping of adequate records—lies with the members of this team.

Therapeutics.—At present it is premature to express precise dosages. With continued purification of penicillin, modifications will be made. However, certain general rules have been postulated (*51*) (*53*).

1. Staphylococcal infection with bacteremia.—The focus of the infection, if available surgically, usually is drained. Generally a daily dose of 200,000 to 400,000 units keeps the infection under control. As the patient improves, the dose may be gradually decreased until the patient has recovered. In assaying the clinical improvement, too much regard must not be attached to the temperature chart, for the lessening of pain, improvement of appetite, and a sense of well-being are equally important (*52*). The total amount of penicillin required may be 500,000 to 2,000,000 units given over a period of 7 to 14 days. Penicillin does not control staphylococcal endocarditis (*51*).

2. Staphylococcal infection without bacteremia.—Open lesions of osteomyelitis may respond to repeated changes of moist dressings dipped in a saline solution of penicillin containing 250 units per cc. Burns and pyogenic skin infections are favorably influenced by the wet dressings or a neutral cream containing penicillin. The treatment of empyema calls for the use of 50,000 units twice daily directly into the pleural cavity. Supplemental intravenous or intramuscular injections of penicillin are usually required in these types of infections.

3. Streptococcal infection.—Circumscribed lesions are best drained. With the exception of the resistant thermophilic S. faecalis group, a smaller dose (100,000 units a day) subdues this sort of infection. Penicillin is ineffective in subacute bacterial endocarditis.

4. Gonorrhea.—This disease is generally cured by the use of 100,000 to 150,000 units in divided doses intramuscularly every 3 hours or by the continuous intravenous administration over a period of 12 to 18 hours (*44*).

5. War wounds.—Lyons (*51*) in a comprehensive article, which should be read in the original ,reports the largest experience to date. Because penicillin alone does not control the polymicrobial character of wounds, surgical intervention for the removal of foreign bodies and sequestra is necessary. Locally applied penicillin, particularly in the anaerobic infections, is most important. Adequate therapy (at least 200,000 units per day) by other routes is indicated.

6. Actinomycosis.—Temporary improvement has been noted (*31*).

7. Malaria.—This is uncontrolled by penicillin (*51*).

The author is greatly indebted to Dr. Arthur L. Bloomfield, Professor of Medicine at Stanford University, for advice in the preparation of this paper.

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PSYCHOSOMATIC MEDICINE

"Psychosomatic medicine" is a new term, but it describes an approach to medicine as old as the art of healing itself. Physicians have always known that the emotional life has something to do with illness, but the structural concepts of disease introduced by Virchow led to the separation of illness from the psyche of man and a consideration of disease as only a disorder of organs and cells. With this separation into many different ailments came the development of specialists to attend to all of these distinct diseases. With the specialists came the introduction of instruments of precision, and the mechanization of medicine began. Medicine now contented itself with the study of the organism as a physiologic mechanism, impressed by blood chemistry, electrocardiography and other methods of investigation, but unimpressed by, and indeed often holding in contempt, the psychologic background of the patient, which was not considered so scientific as the results of laboratory studies. This period may, in truth, be referred to as the machine age in medicine. It is not to be denied that remarkable developments have occurred during this period of laboratory ascendancy, but it also must be admitted that the emotional side of illness has been almost entirely neglected.—WEISS, E.: Psychosomatic aspects of dentistry. J. Am. Dent. A. 31: 215–220, February 1, 1944.

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FILARIASIS AMONG NAVY AND MARINE PERSONNEL

REPORT ON LABORATORY INVESTIGATIONS [1]

PAUL MICHAEL
Commander (MC) U. S. N. R.

The growing incidence of filariasis among Marine and Navy personnel returning from certain areas in the South Pacific has created many problems which to date remain unsolved. Preliminary reports have been made on the disease as seen in Samoa by Dickson. Huntington, and Eichold (*1*). A preliminary report on the problem as seen in this country has been made by the author of the present paper (*2*). From the studies to the present several important points have been established:

1. The conception of the disease in light of many of the opinions now incorporated in various textbooks should be reconsidered.
2. The incubation period and symptom-free period may be concomitant and be shortened to as little as 2 months.
3. Comparatively few instances of streptococcus contamination have been shown.
4. Symptoms of lymphangitis appear to be due to a combination of specific toxicity of the organism and lymphatic obstruction.
5. There should be a re-evaluation of our present-day diagnostic methods and armamentarium.
6. Mosquito control, with contemplated refinement, should reduce the incidence.
7. The pathologic lesion does not appear to be an irreversible one, i. e., there should be a return to normal tissue integrity and function in most instances.

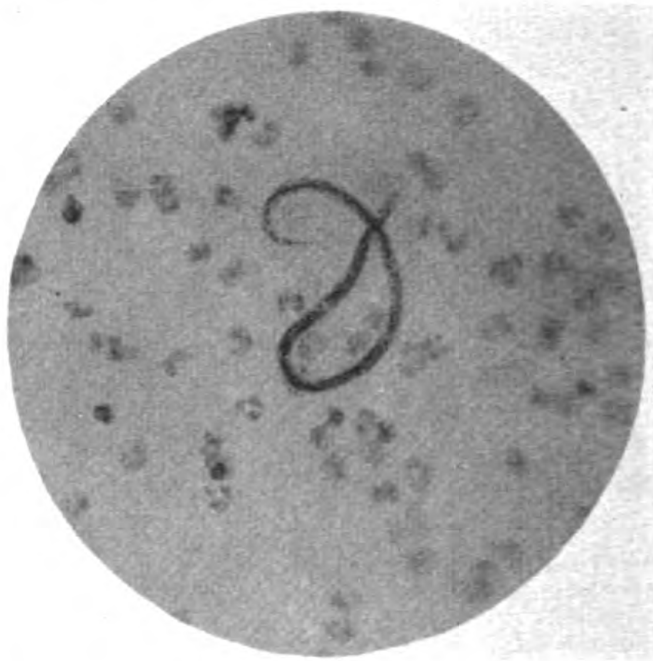
Etiology.—The present study deals with lesions caused by Wuchereria bancrofti. To date Wuchereria malayi has apparently not been identified in any of the patients. Its lesions may be identical to those seen in infection with W. bancrofti.

Filariasis is a nematode infestation present in tropical and semitropical areas of the world. In the Western Hemisphere it is present in Charleston, South Carolina, in portions of Mexico, Central America, the West Indies, and in South America as far south as the Argentine. It is found in the Mediterranean area, Africa, India, south China, southern Japan, the South Pacific islands and in the Southwest Pacific extending as far as Brisbane, Australia. The Samoan

[1] From the U. S. Naval Hospital, Oakland, Calif.

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variety, here under discussion, differs from the others in lacking the nocturnal periodicity of the microfilariae.



1. Microfilaria from peripheral blood of infected native.

Biologic consideration.—Microfilariae range from 200 to 300 micra in length and from 7.5 to 10 micra in diameter (fig. 1). The sheath of W. bancrofti is a delicate membrane in the unstained preparations. In fixed smears, the sheath of microfilariae, when stained by Giemsa or Wright's stain, assumes the same pale blue color as that seen in the cytoplasm of a lymphocyte. The deeply staining column of nuclei extends from a point approximately 10 micra distal to the sheath head and ends approximately 20 micra proximal to the tail end of the sheath. It represents primitive mesenchymal and entodermal rudiments. At the junction of the anterior and middle third of the column of nuclei is a tangential clear space called the neural ring. Slightly distal to this is the excretory pore, or V-spot. The genital cells 1, 2, 3, and 4 are proximal to the anal pore or tail spot. There is a wide space between the large G 1 and the small G 2 cell.

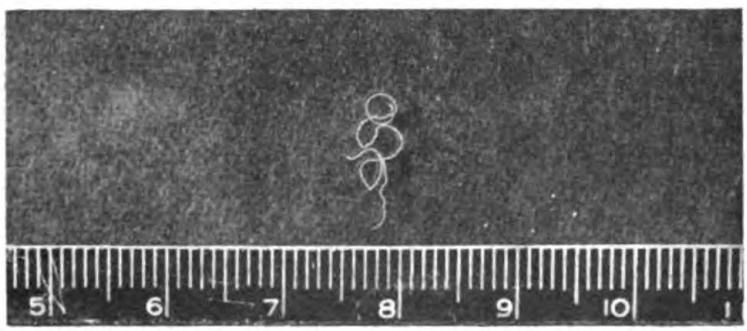
Blood studies.—Several thousand thick and thin smears taken at various intervals during both day and night hours have proved to be negative for microfilariae. In addition to smears, both the Knott concentration and massive concentration methods have been used, and as yet no microfilariae have been demonstrated in the peripheral blood. Correlating these findings with the studies made on lymphatic tissue of the patients lends support to the belief that microfilariae will probably not be demonstrated in appreciable numbers, if at all. Unquestionably at some time in the cycle of the parasite, microfilariae were

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present in the circulating blood, but this occurred long before clinical symptoms ever developed. Moreover as they were present in such small numbers, it is questionable if they were sufficiently concentrated to be of any diagnostic importance.

It is obvious that this problem is far different from that observed in endemic areas where large masses of the native population are infected and microfilariae may be demonstrated in the blood at will. It is rather hazardous to guess what might have happened in four of our patients from whom lymph nodes were removed and adult female pregnant W. bancrofti recovered. It is problematical whether the microfilariae would have survived the action of the natural defense mechanism of the body. The possibilities are decidedly lessened when the optimal factors of tropical humidity and temperature are removed by change to temperate climates. It is a well established fact that environmental factors, higher altitudes, cool climatic conditions, and lessened humidity play an important role in decreasing the viability of the parasites.

Hematologic investigation revealed little which may be considered of diagnostic importance. The patients showed a slight rise in total white blood cells, ranging from 9,000 to 11,000 in most instances. There was a relative lymphocytosis, this ranging from 40 to 60 percent of the counted cells. As many persons returned from the tropics not suffering from filariasis showed this same shift, the significance of the reversal of forms cannot be considered as specific. There was a small increase in the eosinophilic cells in most of the patients, although it rarely exceeded 10 percent. Anemia did not appear to be a problem and the red blood cells showed no morphologic deviations.



2. Slightly enlarged photograph of female W. bancrofti which was alive at time of removal from lymph node. While alive, after being teased out for measurement, it would immediately resume the coiled form as shown above.

Adult worms.—The adult worms are delicate, threadlike nematodes, white in color, which range from 40 mm. for the male to 90 mm. for the female in length, and from 0.10 to 0.25 mm. in diameter (fig. 2). They have a smooth cuticle and are easily transparent when viewed through the low or high power objectives of the microscope. When removed intact they remain alive and active in normal saline for as long as 12 to 24 hours. The anterior end tapers out in a slightly

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rounded head while the posterior end shows a ventral curve. The female ends bluntly, whereas the male ends posteriorly in a rather sharp point.

Man is the definitive host, and approximately 44 different mosquitoes may serve as partial or complete host for development of the mature larvae (intermediate host). The most common intermediate hosts are Culex quinquefasciatus and Aëdes scutellaris. Other less common transmitters are Culex pipiens, Aëdes rossi, Aëdes variegatus and Anopheles costalis.

The mosquito probably causes a concentration of microfilariae at the site of the bite by action of its salivary secretions. The first step after ingestion is a dissolution of the sheath in the gut of the mosquito. In approximately 6 hours after ingestion the microfilariae penetrate the gastro-intestinal wall and localize in the thoracic muscles, where two metamorphotic changes take place. The infected larvae become mature in approximately 2 weeks and migrate to the proboscis, and are then capable of transmitting the disease.

The larvae of Wuchereria bancrofti are lymphotactic in character. That is, after the infective microfilariae are deposited upon the skin, they are attracted through the mosquito bite wound by the exudation of excessive lymph. From here they penetrate through the superficial lymphatics to the peripheral lymph channels and lymph nodes where development and maturity occur. In these tissues mating and parturition take place.

Clinical symptoms.—The study of these patients has afforded an excellent opportunity for clinical research, especially in regard to incipient stages of the disease. Most of the medical literature on the subject is concerned with the terminal or elephantiasis stage, although Samoan lymphangitis or mumu has been known to exist for a considerable period and was described by Buxton over 20 years ago. It is not the purpose of this paper to consider the many clinical features of the disease, and for a more detailed account of the clinical symptoms of these patients reference should be made to standard textbooks on tropical medicine.

Although the symptom-free period may vary greatly from 1 or 2 months to 12 months, the majority of our patients developed their first symptoms from 7 to 9 months following their initial exposure. Constitutional symptoms consist of chills, mild fever, general malaise, nausea, and occasional photophobia. Patients frequently note painful swollen red areas in the extremities which later involve the adjacent lymph nodes, followed by a retrograde or centrifugal lymphangitis. A vast majority of the patients show a funiculitis with or without epididymitis, orchitis, or hydrocele. Grace (*3*), in his studies of tropical lymphangitis in British Guiana, states that four-fifths of his patients showed an involvement of the lower limbs, followed in turn by the upper limbs, breast and the scrotum.

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In our series, as well as those reported by Buxton and later by Dickson, Huntington, and Eichold, the highest incidence showed an involvement of the scrotum, followed by the upper extremities and then the lower extremities. The initial attack lasts from a few days to weeks, followed by remissions. The majority of the patients have had one or more relapses following the initial attack. During the remissions the involved areas may regress and the patients show few if any physical signs. During this period they may enjoy a period of good health. It has been our observation that the periods of remission have become longer and the duration of relapse shorter with each subsequent attack. The reason for this will be considered later in the discussion dealing with anatomic changes in the body.

Skin tests.—Huntington has already made a preliminary report on the results of his skin tests on controls as compared to patients suffering with mumu. Out of 137 mumu patients tested, he found 114 or 83.1 percent showing positive immediate and delayed reactions. He used an extract of Dirofilaria immitis antigen obtained from Samoan dogs. Using identical technic and the same type of antigen of Dirofilaria immitis, we have tested 307 known filariasis patients and found 268 or 87.3 percent showing positive immediate and delayed reactions. This percentage compares very favorably with Huntington's figures and one must conclude that skin testing with Dirofilaria immitis antigen is a definite diagnostic aid. As all of our patients at the time of testing had stools negative for other nematodes, our results are significant.

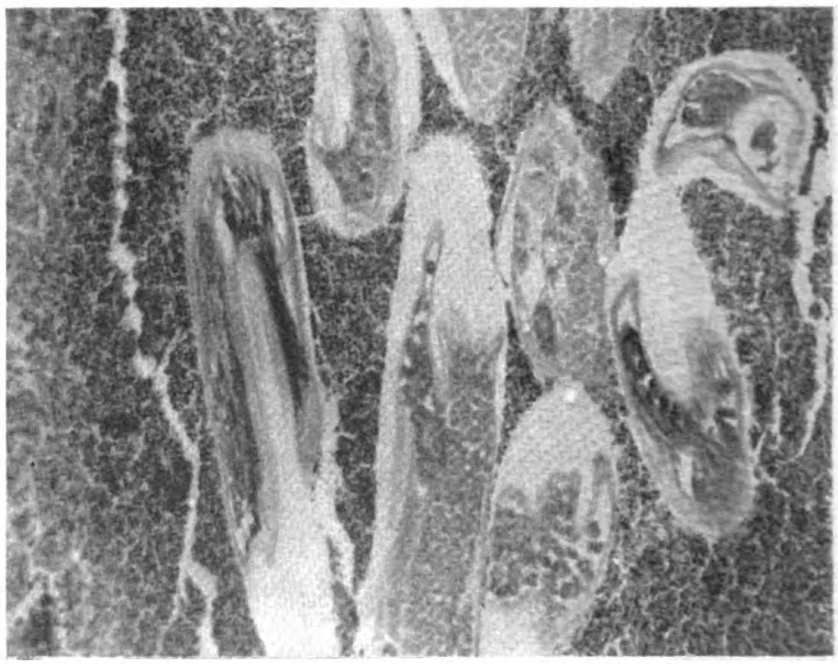
Bacteriologic considerations.—Well qualified authors are so diametrically opposite in their views on the role played by the beta-hemolytic streptococcus as a causative agent in lymphangitis that one must conclude that other factors enter into the problem. Grace found in his British Guiana studies that beta-hemolytic streptococcus was present as the most common organism in lymphangitis or abscess formation. He quotes Rose who found beta-hemolytic streptococcus present in node punctures in almost 90 percent of persons hospitalized with acute lymphangitis. O'Connor and Hulse (*4*), however, found this organism to be of negligible importance as a complicating factor so far as their studies in Puerto Rico were concerned. Other factors must exist which would explain the discrepancies of bacterial contamination. In areas of extremely heavy rainfall and intense humidity the chances of such contamination are greater.

Another factor which must be considered is the physical status of the individual. A person in excellent general physical condition is less likely to develop secondary bacterial growth in the lymphatic tissues than is a poorly nourished native with numerous foci of infection. The degree of pruritus and associated scratching is another factor which has a direct bearing on the problem. It is of little wonder that secondary infection among healthy young adult Marine

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or Naval personnel rarely occurred. We cultured 100 filariasis lesions and in only one instance did we find any bacterial complication. This was obviously a skin contamination by Staphylococcus albus and occurred in a superficial lesion which communicated directly with the skin. Gram stains of other typical filariasis lesions failed to show any bacterial organisms.

Histopathologic changes.—Detailed study upon lesions of these patients has shed considerable light on anatomic changes occurring in the human body. After discouraging results in establishing the diagnosis by means of blood smears and various concentration procedures, it was decided to resort to biopsy methods. At this time we did not have access to O'Connor and Hulse's work on the subject, but our findings arrived at independently substantiated many points



3. Section of lymph node showing a living, pregnant female Wuchereria bancrofti. Note the double uterus containing embryonic microfilariae. The characteristic ova are well seen in other segments and the lymph node presents a very heavy eosinophilic cellular reaction surrounding the worm.

observed by them. In addition to their description, several new features were observed and recorded. It was soon determined that surgical investigation of spermatic cord lesions was an unwise procedure, as patients may develop complicating relapses following operative intervention. Although some authorities advise against biopsy, it has been our observation that removal of lymph nodes or lymphatics of the upper extremities has in no way harmed the patient.

Conversely, we feel that removal of these foci has definitely resulted in improvement in several instances. This would seem logical in view

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ct that four adult pregnant female worms were obtained, thus g possible hazardous foci. Both lymph nodes and lymphatic were biopsied and our results may be summarized in more follows.

first place, according to anatomic criteria we were dealing ions caused by Wuchereria bancrofti (fig. 3). The adult or nt worms were coiled and showed variations in diameter ments, depending upon the level through which the segment The cuticle was smooth and showed a pale homogeneous en stained with hematoxylin and eosin. The uterus occupied dous portion of the body and contained ova measuring approx-20 to 30 micra in diameter. In adolescent or mature pregnant the anterior uterus contained large numbers of embryonic riae. Both the ova and microfilariae retained the hematoxylin The uterus itself was double. As already stated, these worms l from 0.10 to 0.25 mm. in diameter. The pathologic picture evelops is dependent upon the location, the condition of the nd the age of the process. In our experience, the greatest of positive biopsies were obtained from distal lymphatic of the upper extremities. In all these lesions, however, the appeared relatively old, and the worm in various stages of ation.

on the study of serial section of numerous biopsies of lym-essels in these areas, it becomes apparent that the pathologic followed a certain sequence. The endothelium lining the ic channels becomes thickened, thrown into folds and in many ssumes stratification. When a living worm is present in the ic channels, fibrin becomes deposited upon the endothelial the wall of the lymphatic vessel becomes edematous and y thickened and there is a heavy cellular infiltration of ilic cells. As degeneration ensues, the tissue reaction becomes ecific in appearance. Worms ranging from partially dis-ed to obviously dead and even calcified forms, may be seen he remaining lumen and in the walls of the lymphatic channel. sel becomes thickened by proliferation of the filarial granula-ue which is almost pathognomonic of this disease. Caseating worm segments are represented by a central core of necrotic ith a stellate radiating proliferation of endothelial cells, fibro-pithelioid cells, and numerous foreign-body giant cells. There er dense zones of eosinophilic cells surrounding the necrotic These cells are particularly concentrated around the peripheral of the foci, between the cellular tissue and the fibrous granu-

lation tissue. The granulation tissue appears to be arranged in palisades, frequently following a wavy undulating pattern. This distribution would appear to conform with the coiled segments of the parasite.

In most of the lymphatic channels, degenerated worm segments may be seen, many of which are undergoing calcification. Calcification would appear to start centrally and proceed peripherally, involving the cuticle last. This is borne out by the fact that the majority of the segments will show central calcification within the uterus, with a preserved cuticle. In some of the forms, however, the cuticle is undergoing lipoid degeneration with early saponification preparatory to calcification. It would appear that the obviously poor blood supply and lessened viability of the cells result in the formation of a succession of alkali soaps, with final deposition of calcium salts in the cuticular membrane. These latter observations are in disagreement with those made by O'Connor and Hulse, who felt that calcification was first seen in the cuticle, and later involved the body of the worm.

From these active cellular foci of rather specific structure, the surrounding granulation tissue merges into one of a rather nonspecific nature, consisting of mature fibrous tissue with some hyaline degeneration. The lesion throughout is avascular, which lends support to the above theory of calcification. From studying sections of lymphatic channels of this nature, one cannot doubt the theory that the lymphangitis is due not only to a specific allergic reaction in response to the worm or microfilariae, but to partial obstruction of the lymphatics as well.

In one patient the fibrosed lymphatic vessel contained scattered degenerated microfilariae loose in the granulation tissue. Many of these were fragmented and some showed early calcification. This was particularly interesting in view of the fact that the adjacent mother parasite was obviously dead and heavily calcified.

A somewhat different histologic picture was seen in observing the lymph node tissues. The study of lymph nodes again establishes the fact that this lesion also is dependent upon the age and condition of the parasite. In those nodes where the parasite was obviously living and mature, the histologic picture was very distinctive. The worms were present in the afferent lymphatics or medullary sinuses. In almost all instances the afferent vessels were hyperplastic, forming varices which protruded into the deeper portions of the lymph nodes. The growing worms held within these varices were surrounded by a rather specific type tissue reaction. There was a dense zone of heavily packed eosinophilic cells immediately surrounding the worm. This central focus merged into edematous lymph follicles with intact

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germinal centers showing increased mitotic figures. Plasma cells were increased in the cortical areas and the entire node was edematous. Edematous fluid was seen in the form of large pink-staining lakes of albuminoid fluid held within the sinuses. The cuticle of the worm stained a homogeneous pink while the ovaries and embryonic microfilariae stained a characteristic blue with hematoxylin and eosin. There was relatively little change in the lymph node other than those points already described. Enlargement of the node was then presumed to be due to three factors, i. e., the presence of the parasite, edema, and generalized hyperplasia of the node.

When degenerative changes begin to occur in the worm, both the parasite and lymphoid tissue of the host will show histologic variations from the above description. As degeneration occurs, the outlines of the parasites will be somewhat obscure and the staining reaction will be altered. Instead of the clear-cut basophilic staining, the nuclei of the ova will become pyknotic, with cloudy swelling in the cytoplasm. This progresses on to degeneration, death and even calcification. Accompanying these parasitic changes are histologic deviations in the host. Degeneration of the worm is directly proportional to the degree of endothelial hyperplasia, as this process appears to be dependent upon the response put forth by the reticulo-endothelial system. This cellular granulation tissue is gradually replaced by proliferative granulation tissue with numerous histiocytes and foreign-body giant cells. The final outcome is one of dissolution and absorption of the parasite, fibrous tissue replacement, and disappearance of most of the specific diagnostic criteria. As these degenerative reactions progress, eosinophilic cells appear to decrease in number, and in the chronic fibrotic lesions they are only sparsely scattered through the granulation tissue.

In all four instances where adult female and pregnant worms were observed, male forms were found in the same lymph nodes. The males were in varying stages of degeneration.

It would appear from the above description that these parasites create a recticulo-endothelial response which attempts to destroy, engulf and absorb both the worm and the microfilariae. Realizing this fact, the eventual outcome and prognosis of these patients on histologic grounds is dependent upon certain factors. These are:

1. The degree of parasitism on a quantitative basis.
2. The localization of female and male worms in proximal lymphatic tissues for mating.
3. The degree of reinfection which has occurred.
4. The activity of the patient's reticulo-endothelial system, which appears to be a variable factor.
5. The degree of sensitization of the patient.

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The degree of parasitism in the patients under our observation did not appear to be very high. Isolated foci of living or dead parasites have been demonstrated in 30 percent of 120 biopsy specimens. Of the positive biopsies, 70 percent were found in peripheral lymphatic channels, the remaining occurring in lymph nodes.

Naturally no correlation can be made between the microfilarial rate and the disease incidence; as has already been stated, microfilariae were not demonstrated in the peripheral blood.

One specific instance may be reported in more detail illustrating a method of diagnosis not generally known. A coxwain, aged 26 years, had been stationed on Wallis Island for 7 months when he first reported to the sickbay complaining of swelling and pain in the right testicle and cord, together with pain in the right arm of 10-days' duration. This subsided, but 1 month later he had a recurrence of symptoms which lasted 2 weeks. At the end of this period he was evacuated to the mainland for further hospitalization. Subsequently, approximately 10 months after his first exposure, a large swollen, painful lymph node was removed from the right axilla. This node measured 3.5 by 2.5 cm. in size and appeared pale and edematous. On hemisection no parasites were seen grossly. It was also cultured and proved to be sterile. It was then immersed in normal saline, maintained at 37° C., and observed from time to time. At the end of 28 hours of immersion, a pale, coiled, creamy white, threadlike worm was observed in the immersion fluid. This was placed in a Petri dish, reimmersed in fresh saline and observed through the low and high power objectives of the microscope. It was identified as a mature female W. bancrofti containing embryonic microfilariae. It remained alive and active under almost constant observation for 6 hours, at which time it was placed in 10-percent formalin for preservation.

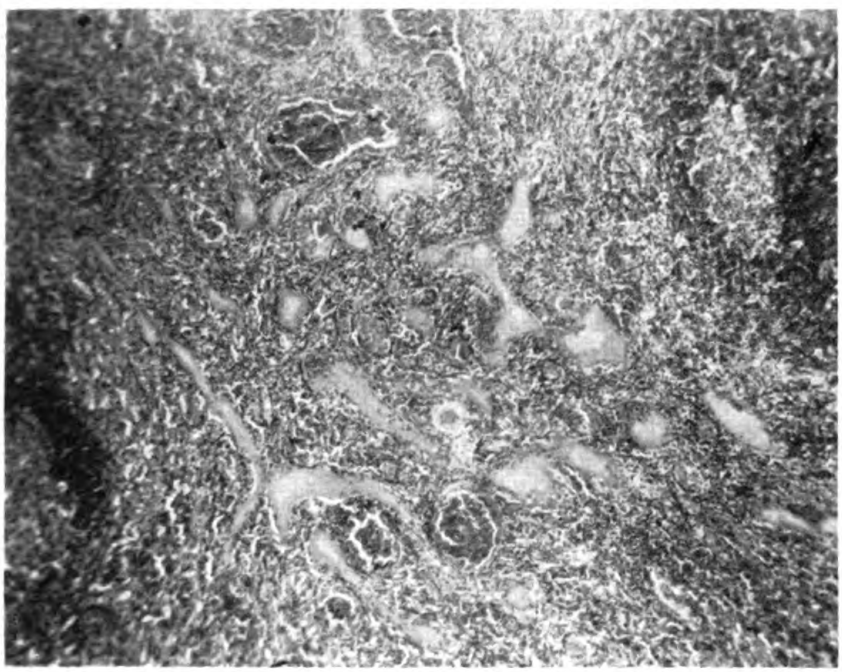
This procedure was repeated several times in other patients and active motile worms were recovered in two. These remained in a state of good preservation for as long as 12 hours. Both these latter two worms were male W. bancrofti. Several other similar attempts were made which proved to be unsuccessful, and on subsequent serial section examination of these nodes, dead degenerated forms were found. This technic simplifies the laborious procedure of minute dissection.

Allergic reactions in persons sensitized to Wuchereria bancrofti have been described by O'Connor and others. In addition to our findings in this regard already reported, several other observations may be recorded. "Fugitive swellings" were seen in many patients. These consisted of raised, red, blotchy, somewhat tender areas occurring in the arms, legs, or torso, which persisted for from 2 days to 2

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weeks. In some instances they simulated the lesions of erythema multiforme. When they disappeared, they left little or no residual effect. Three of these patients were biopsied at the height of their lesions and histologic studies showed typical allergic phenomena. The tissues appeared edematous with vascular engorgement and some perivascular round cell infiltration. The supporting structures were edematous and there were numerous eosinophilic cells present. No worms or microfilariae were seen.

As confirmatory evidence of this phenomenon, two other instances will be reported, showing this reaction in deeper structures. The first report is that of a Marine, aged 22 years, who was transferred to the mainland because of funiculitis and scrotal enlargement on the right side. His first symptoms occurred 9 months after his initial exposure. When he arrived at this hospital his lesions were confined to the right side as described, and there was also present an enlarged, somewhat indurated, inguinal lymph node on the same side. During his first 10-day stay at this hospital, he was symptom-



4. Section of lymph node showing the typical allergic response with characteristic fluid lakes and generalized hyperplasia. These nodes contain large numbers of eosinophilic cells.

free and showed no physical findings except those already described. One afternoon at 1600 he complained to his ward medical officer of a swelling in the left inguinal region in an area hitherto uninvolved. He was periodically observed and it was noted that a lymph node on the left side was becoming progressively enlarged. At 1700 the same afternoon inguinal nodes from the right and left side were removed under local anesthesia.

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The right node from the older lesion was studied by serial sections and showed the presence of a dead degenerated female W. bancrofti. The left node was cut and studied serially. In none of the sections of this node was there any evidence of microfilariae or worm parasites. Instead the lymph node showed marked hyperplasia of the primary and secondary follicles, with large numbers of eosinophilic cells throughout. Scattered through the node, especially the sinuses, were lakes of pink-staining edematous fluid (fig. 4). This lesion recalled the histologic picture seen in the "fugitive swellings" of the skin.

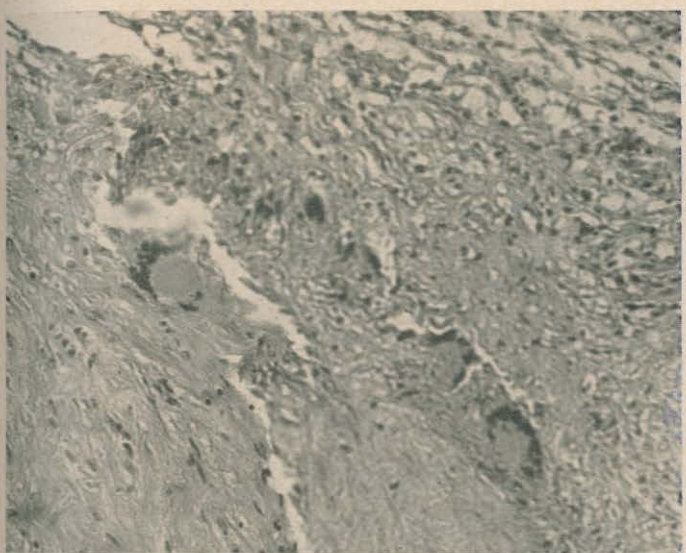
The second instance of great interest was observed in a Marine gunner, 50 years of age, who succumbed to an attack of coronary occlusion and was later autopsied. He had a history of hypertension for some time and had returned from the battle area for survey. He presented the classical picture of coronary artery disease with all the associated findings. The important point, however, was that while in Samoa he had had a bilateral filarial funiculitis, together with an involvement of the left arm.

At autopsy the right testicle measured 8 by 5 by 4 cm. and the left 7 by 5 by 4 cm., with a proportionate increase in the size of the spermatic cords. The tissues were edematous, densely cellular, but showed no evidence of suppuration or degeneration. They were studied according to the O'Connor technic. Because of the large size of the testicles and cords, each side required 47 blocks. These blocks were then cut serially, requiring several weeks for the cutting, staining and microscopic study.

The essential findings in this work consisted of the following: The main lesion observed was a proliferation of lymph channels in the cord and tunica albuginea, especially the anterior cord lymphatics. In these areas the surrounding tissues were edematous and rather pale. Instead of a true lymphangitis there was a perilymphatic exudation of round cells, with a few scattered eosinophils. The lining endothelium was flattened, intact and not remarkable, with no desquamation. The lumina contained no inflammatory cells. Tubules in the epididymis were essentially not changed. They were lined by intact columnar epithelium with no desquamation. Many of the tubules were distended with spermatozoa, suggesting the possibility of partial obstruction due to the swelling and edema of the cord. The interstitial tissues were not remarkable. The testes showed normal epithelium, with normal spermatogenesis. The swelling of the testes was due to edema of the interstitial supporting tissues. This tissue was pale and contained a few eosinophilic cells. There was no degeneration, necrosis, or atrophy. The vas deferens on each side showed no abnormalities.

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e deductions drawn from the latter study may be applied to similar instances of filariasis. A patient entered this hospital March 1943 after 12 months in Samoa. The duration of symp- of filariasis was apparently 4 months. These tissues did not any evidence of the presence of the adult worm or micro- ae. They did not show evidence of filarial infestation as de- ed in the long-standing chronic cases reported by O'Connor Hulse. It would seem, therefore, that the lesion of the genitals is patient is one of a perilymphatic cellular reaction with edema e perilymph spaces, and edema of the interstitial tissues of the . The pathologic lesion would appear to be reversible, that is, the filarial reaction has subsided the genitals should return to al integrity. Decreased fecundity or even sterilization, should



tion of peripheral lymphatic channel showing the characteristic granula- tissue reaction caused by Wuchereria bancrofti. Note the edema, multi- leated giant cells, and fibrous tissue hyperplasia.

ur, would seem to be temporary, and due to partial obstruction e tubules of the epididymis from edema of the cord. Certainly l inflammation or tissue destruction and degeneration were al- negligible.

may not be assumed that the study of one single example should to generalizations on the subject except that this patient showed indings of early filariasis and typified what one would probably n so many other instances. The process would appear to be the t of the toxic or allergic effects of filariae with a special selec- for the genitals. Certainly there were no filariae present in

the tissues studied, and the tissue reaction was far different from that seen in our previous positive biopsies wherein filariae were demonstrated.

It would seem that in the development of the classical pathologic picture of filarial involvement of the genitals, with later destruction, necrosis, or even calcification, there is at first a stage of tissue sensitivity, manifested by edema and perilymphatic cellular invasion as seen in this instance, due to the presence of the worms elsewhere: in this instance the upper extremities. A further and later step would be the actual invasion of the adult worms, with development of characteristic granulation tissue and foreign-body reaction, leading later to destruction or even calcification. Such a picture was not seen here. If one can hazard an opinion from a single case report, then it would seem that sterility, if it develops, should be of a temporary nature, and the genital lesions should return to normal tissue integrity in most instances.

Mention has been made several times in this paper of the importance of serial sections, and too great stress cannot be placed upon this procedure. We were unable to tell by simple gross inspection of the nodes or unstained slides as to the relative probability of positive results. Any method of diagnosis short of serial section technic is inadequate and may lead to false conclusions. Lymph nodes or lymphatics were biopsied in 120 patients, 30 percent of which were diagnostic in demonstrating the actual presence of the worm. Seventy percent of the positives were obtained from lymphatic channels, the remainder occurring in lymph nodes. The greater chance of positive biopsy, therefore, would be in surgical removal of lymph channels, although there was a greater likelihood of obtaining living worms from lymph nodes.

In studying the serially cut sections of the positive biopsy specimens by microscope, the presence of the worm could be predicted long before it came into view, by the rather typical reaction observed in the tissues studied. This consisted of eosinophilic infiltration, lakes of edema, hyperplasia of the nodes and a characteristic reticuloendothelial response. When dead worms were present, the typical granulation tissue was observed before degeneration or calcified worm segments were demonstrated. In those lymphatics and lymph nodes where no worm was identified, it was felt that a presumptive diagnosis of filariasis could be made by a careful study of the tissues. This reaction was very similar to that described above in the outer margins of positive biopsies. The fact that the worm was not demonstrated may have been due to two factors. One explanation may be that this reaction is allergic in nature due to worm foci elsewhere. The other

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explanation may be due to the fact that the worm had been destroyed, engulfed, and had already disappeared from the tissues in question. As there was some variation in the histopathologic picture of these tissues, probably due to differences in age of the lesions, it may be assumed that both explanations are correct.

As many of these patients suffering from filariasis may be surveyed from the service and returned to civil life, a word of caution should be given to pathologists, especially those in civilian life. As the granulomatous lesion of this disease is relatively unknown to most pathologists in this country, the possibility of diagnostic errors must be considered. The histopathologic picture at certain stages closely resembles tuberculosis or lues, and in some instances atypical Hodgkin's disease. Because of this, filariasis must be added to the list of diseases of the reticulo-endothelial system in any differential diagnostic problem.

SUMMARY AND CONCLUSIONS

Filarial lymphangitis is a disease which has become extremely important from the military point of view, because of the relatively high incidence among Navy and Marine personnel stationed in certain endemic areas. Certain precautions and adequate mosquito control, however, will largely reduce the incidence of this disease. Anatomic and histologic studies have shed considerable light on the disease, especially in regard to progress and prognosis. Based upon these histologic studies and the fact that we were unable to demonstrate microfilariae in the peripheral blood stream, it may be concluded that this disease will not become a public health problem in this country. It should be stressed, however, that filariasis should be ruled out in certain atypical lymph node diseases.

It is our belief that lymph node and lymphatic channel biopsies of the upper extremities cause no harm to the patients and this method affords the best means of diagnosis. Biopsies may be classified as positive or presumptive. The positive biopsies are those in which the worm or worm segments are actually demonstrated, whereas presumptive biopsies are those in which rather suggestive histologic findings are observed.

Many of the lesions of filariasis are believed to be allergic in nature due to filarial foci elsewhere in the body. Certain lymph node, testicular, and spermatic cord enlargements, together with the so-called "fugitive swellings" of the skin may be explained on this basis.

No specific effective therapeutic agent has as yet been demonstrated. It is felt, however, from the detailed studies of tissues removed from filariasis patients that the natural defense mechanism of the body, the removal from endemic areas, and prevention of reinfection will probably result in a self-limited course. From our present knowledge, it

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would be too empirical to postulate an opinion as to the time limit for this lysis to occur.

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DIAMIDINO-STILBENE IN KALA-AZAR

Diamidino-stilbene is by far the most potent of the aromatic diamidines tested so far in the treatment of kala-azar. The immediate cure rate in Indian kala-azar is about 98 per cent, and the proportion of cases relapsing after a single course of treatment is very low. The use of this drug has however certain drawbacks. The intravenous injections are usually accompanied by certain unpleasant reactions. Toxic reactions which developed some months after the disease had apparently been cured were serious.

The principal features of this syndrome are paraesthesia and partial anaesthesia in the trigeminal area with loss of sensation of light touch, with preservation of sensation of pain, temperature, and pressure.

The lesion is in the principal sensory nucleus of the trigeminal nerve in the pons, and is probably of the nature of a toxic degeneration. Diamidino-stilbene is the toxic factor responsible, and the selective toxic action is probably due to the ethylene component of this compound.

We know that trichlor-*ethylene* inhalation in industry was reported to produce bilateral loss of sensation confined to the distribution of the trigeminal nerve and that inhalation of trichlor-*ethylene* alleviates the symptoms of trigeminal neuralgia. It seems that the selective toxic action on the sensory nucleus of the fifth nerve of diamidino-stilbene, *i. e.* diamidino-di-phenyl-*ethylene*, is probably due to the ethylene component of the compound. No case treated with diamidino-diphenoxy-pentane (Napier and Sen Gupta, 1943) has so far been found to have developed any such neuropathy.

The condition is not dangerous to life and is not progressive; in most patients there is a tendency to slow recovery.

In cases having troublesome paraesthetic symptoms, all therapeutic measures (nonsurgical) have been found to be useless except injections of solution of cobra venom (1:100,000) in gradually increasing doses which produce some degree of subjective improvement.—SEN GUPTA, P. C.: Observations on neuropathic sequel of diamidino-stilbene therapy in kala-azar. Indian M. Gaz. 78: 536–543, November 1943.

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FILARIASIS SUSPECTS

REVIEW OF CASES ADMITTED

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During the first months of 1943 one hundred twenty-five patients with Diagnosis Undetermined, Filariasis, were admitted to this base hospital for disposition. The group represents only enlisted personnel.

As all of these patients were young, healthy, white males who originally came from areas where this infestation is rare or absent, it is believed that the findings are interesting enough to review. This report is not intended to be a comprehensive study of filariasis or a review of the history of that disease. These topics have been adequately covered by authors who have had years of experience in tropical medicine. It is hoped that the observations made at this activity regarding the effects of filariasis on white men will give better understanding of the disease; it is, moreover, intended to restrict the discussion of filariasis in this paper to that condition due to infestation by Wuchereria bancrofti.

BACKGROUND OF PATIENTS

Every case reviewed here was admitted from a single Marine raider battalion. This battalion was formed in American Samoa in September 1942 and trained in groups in American Samoa, British Samoa, and Wallis Islands. It was reformed as one battalion in December 1942, left the Samoan area and spent the intervening time in the New Hebrides and Russell Islands before members of it began to be admitted to this hospital in March.

The advantages of having all the patients come from one such unit are many. The exact time each person spent in the Samoan area can be accurately determined; there are records to support their true ages, and they fall into an age group that provides for the young and healthy. It makes certain that none of these men was exposed to this type of infestation or had this disease before the present illness.

This was one of the first military groups to live in the Samoan area under the same conditions as the natives. They had night maneuvers there and were required to sleep in the bush. There was a certain intermingling of the natives and the men, as the natives at-

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tended the open air movies in the evenings and the younger native girls attended the dances arranged for the enlisted men.

PROCEDURES FOLLOWED IN STUDYING THESE CASES

Besides a careful history and physical examination on these individuals, there was obtained from each a day and night blood concentration for microfilaria bancrofti, urinalysis, blood count, routine malarial smear, and blood Kahn. Aspiration of the inguinal lymph nodes was done on 5 patients. In 59 of these cases lymph nodes were excised for biopsy. On one (the only case that showed this finding) material was aspirated from a hydrocele for study.

In taking the history, the age was first determined. The patient was then questioned as to the area in the States he lived in before coming into the Pacific area. Next was elicited as accurately as possible the time interval between his arrival in Samoa and the appearance of the first complaint, no matter how slight. It was a rarity for any of the patients to have involvement in only one area, i. e., the original complaint might be painful swelling of the right groin, but after that there might be involvement of the other groin, or the same complaint referable to an arm.

The physical examination given was a complete one, but especial attention was given to enlargement of the lymph nodes—axillary, epitrochlear, inguinal, femoral and popliteal; enlargement of the testes; presence of hydrocele; and lymphangitis. Regarding the inguinal lymph node determination on physical examination allowance was made for the fact that the patients were trim, young adults in whom these nodes may be easily palpated. When an enlargement was found to fall in what may be questionably called a normal range or when it could be due to some other infections, as repeated, slight infections of the legs, it was classified as one plus. This does not hold for nodes in other areas. No differentiation was made between cystic and fibrotic nodes. To complete the physical examination, a genitourinary consultation was obtained on each of these cases.

An explanatory note should be injected here relative to the laboratory work and pathologic studies. For obvious reasons, this hospital was not equipped for research work. Although repeated blood smears and other work may have been desirable, it was too much to ask of an already overworked but willing laboratory staff. Time also was a factor. These cases were here for evacuation at the earliest date, not for study.

The following procedure was followed in preparing the blood smears. One cubic centimeter of venous blood was withdrawn in 10 cc. of a 10-percent solution of formalin. This was centrifuged for 10 minutes

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and the supernatant fluid drained off. Then 10 cc. of distilled water was added and centrifuged again for the same amount of time and the supernatant fluid again drained off. The sediment was used and stained with Wright's stain. Each slide was examined for 15 minutes. Because of the few number of microfilariae found in the cases that had positive blood and aspiration material findings, no attempt was made to graph any filarial periodicity charts.

Routine and microscopic urinalysis was done on each and careful attention was given to the presence of chyle or fat droplets. A hemoglobin percentage was obtained and if above 80 percent no red count was done. A total white count and differential was done on all. Malarial smears were done in the routine manner. The aspiration material from inguinal lymph nodes was obtained by a hypodermic needle after careful cleansing of the overlying skin. The procedure followed in obtaining the lymph nodes will be discussed in the part of the review dealing with the lymph nodes.

The following statistics were compiled:

1. *The average age.*—(a) For the blood and aspiration material positive cases—23.2 years, with the oldest being 28 and the youngest 20. (b) For the entire group—21.8 years, with the oldest being 49 and the youngest 18.

2. *The average time in Samoa.*—(a) For the blood and aspiration material positive cases—10.8 months, with the longest period being 22 months and the shortest 6 months. (b) For the entire group—7.4 months, with the longest period being 22 months and the shortest 2 months.

3. *The average time interval between arrival in Samoa and appearance of first complaint.*—(a) For the blood and aspiration material positive cases—10.2 months, the shortest interval being 8 months and the longest being 14 months. (b) For the entire group—7.6 months, the shortest interval being 1 month and the longest interval 15 months.

4. *The original complaint.*—In order of frequency, the original areas of pain or swelling were: (a) For the blood and aspiration material positive cases—right testicle—2 cases; right groin—1 case; right arm—1 case; left arm—1 case; left testicle—1 case; both testicles—1 case; left leg—1 case. (b) For the entire group—right arm—27 cases; right groin—21 cases; left arm—16 cases; both groins—12 cases; left testicle—12 cases; left groin—11 cases; right testicle—10 cases; both testicles—6 cases; both arms—4 cases; right leg—4 cases; left leg—2 cases.

5. *Order of frequency of lymph node enlargement.*—(a) For the blood and aspiration material positive cases—both inguinals—8 cases; both femorals—8 cases; both axillaries—2 cases; right axillaries—1

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case; right epitrochlears—1 case; both epitrochlears—1 case. (b) For the entire group—both inguinals—119 cases; both femorals—115 cases; both axillaries—58 cases; left epitrochlears—22 cases; right epitrochlears—19 cases; both epitrochlears—20 cases; right axillaries—12 cases; left femorals—11 cases; left axillaries—7 cases; right femorals—1 case; right inguinals—1 case; left inguinals—1 case.

6. *The average white count.*—(a) For the blood and aspiration material positive cases—average white count was 7,700, the highest being 9,900 and the lowest 6,000. (b) For the entire group—average white count was 8,170, the highest being 19,000 and the lowest 3,600.

7. *The average eosinophil percentage.*—(a) For the blood and aspiration material positive cases the average was 11 percent, the highest being 22 percent and the lowest 2 percent. (b) For the entire group the average was 4.6 percent, the highest being 38 percent and the lowest 0 percent.

LYMPH NODES

In all, 59 lymph nodes were excised for study. In 51 cases these were removed from the inguinal region and in the remaining 8 cases from the epitrochlear region. Unfortunately none of these nodes was obtained from a patient with blood positive for microfilariae. This is understood when it is explained that these patients were received in groups, not as a single unit. The ones with positive blood were in the first few groups and at that time facilities were not available to study sections. When the facilities were on hand no more blood positive cases were received.

The nodes were obtained in the usual way. They were removed under aseptic conditions, placed in a sterile container, marked with the patient's name and region from which it was removed and then sent to the laboratory for study. All of these cases were diagnosed by the pathologist as showing chronic lymphadenitis. In 24 cases the diagnosis, in addition to this, was given as probable filariasis even though no adult worms were demonstrated.

COMMENT

Relative to the admitting complaint of pain or painful swelling of a certain area, it is interesting to note that the attack would last from 3 to 5 days and then subside without treatment or rest. Recurrences frequently initiated by exercise were the usual sequence, at irregular intervals, the recurrence lasting about the same length of time as the original attack. Whether these were attacks of lymphangitis can only be surmised. Only two cases of true lymphangitis were observed in the hospital, showing the usual signs of redness, heat and swelling. In all the other cases the original complaint was referable to a lymphadenitis rather than a lymphangitis. This con-

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firms Buxton's observation on "mumu" in European residents of Samoa, namely that lymphadenitis always precedes lymphangitis.

On the other hand it is felt that the physical examinations and laboratory procedures in these cases ruled out certain rare and common diseases of this area, such as yaws, dengue, syphilis, tularemia, leukemia, leishmaniasis, tsutsugamushi fever, etc. Moreover it may be stated that many of the objective findings emphasized by authorities on this subject were absent in this group of patients. Hence no myositis, synovitis, lymph scrotum, lymphatic varices and lymphangiectasis of the spermatic cord, chyluria, lymphuria, chylous ascites and chylous diarrhea or elephantiasis were observed.

The question of eosinophilia receives some slight attention because of the mention made of it in almost all nematode infestations. As to its importance, Stitt states that it occurs less uniformly with Wuchereria bancrofti than in infection with Loa loa and that in the absence of intestinal helminths, the presence of an eosinophilia may be of aid in the diagnosis. A leukocytosis may aid in excluding malaria.

Finally it must be stated that no therapy was instituted here, as none of these patients was in urgent need of medication.

SUMMARY

1. Within a 2-month period, 125 cases with the diagnosis of Diagnosis Undetermined, Filariasis, were admitted to this hospital for disposition.

2. A total of 8 of these cases, or 6.4 percent, showed blood or lymph node aspiration material positive for microfilaria.

3. In 59 of these cases, lymph nodes were excised for pathologic study. All of these nodes showed evidence of chronic lymphadenitis and 24 of them showed findings that were termed possible filariasis.

4. It was thought that cases not positive as far as blood and lymph node aspiration material were concerned should be regarded as clinical filariasis.



QUININE AND HEARING

Quinine, 0.3 g. daily for 4 weeks, increased auditory sensitivity in the middle range for 2 days then decreased it appreciably. When the quinine was discontinued the original sensitivity was soon regained. When 1 g. per day was taken for 2 successive days at weekly intervals for 3 weeks auditory sensitivity decreased within an hour, after each first dose and returned to normal 25 hrs. after each second dose. The maximum decrease occurred 2–7 hrs. after ingestion and amounted to about 8 decibels at 200–600 cycles and 20 decibels at 600–700 cycles per second.—CLAMANN, H. G., and RISSMANN, R.: Effects on human auditory threshold of mild continuous and heavy intermittent quinine prophylaxis against malaria. Chem. Abstr. 38: 158, January 10, 1944 (Abstract).

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PROTEIN LOSS IN THE SURGICAL PATIENT

Surgical disease as such and in addition operative procedures drain the protein depots of the body and may produce hypoproteinemia.

The average total plasma proteins for 278 surgical patients was 6.58 grams percent with an incidence of hypoproteinemia of 22.3 percent. Hypoproteinemia was common in patients with peptic (most often bleeding) ulcer, in carcinoma of the gastrointestinal tract, bowel obstruction, lesions of the biliary tract, gastrointestinal fistulas, and burns.

The average total plasma proteins following surgery of the 193 patients who were operated upon dropped 5 percent. Of the hyperproteinemic patients 30 sustained an average drop of 11.9 percent, 118 of the normoproteinemic patients dropped 4.6 percent, and 42 of the hypoproteinemic ones showed an average increase of 4.3 percent.—MEYER, K. A., and KOZOLL, D. D.: Protein deficiency in surgical patients. Surg., Gynec. & Obst. 78: 181–190, February 1944.

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METHODS IN DIAGNOSIS OF DEHYDRATION

Clinical symptoms and signs in the diagnosis of dehydration are characteristic, but appear late and the measurement of the urinary output is not an accurate index of the extent of dehydration.

Hemoconcentration on the other hand is an early and reliable finding, as evidenced by an increase in the red-cell count, hemoglobin, hematocrit, blood specific gravity, and serum and plasma protein concentrations. Certain pitfalls however must be borne in mind in evaluating these tests, whereas the study of the electrolyte pattern of the blood plasma is helpful but time-consuming, and changes are slow to appear.

Blood-volume and available fluid-volume determinations are generally not applicable and the McClure-Aldrich test as a means of estimation of the fluid need of the interstitial tissues requires further study.—TEITELMAN, S. L.: Dehydration; analysis of methods used in diagnosis. Surg., Gynec. & Obst. 78: 105–108, February 1944.

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OBSERVATIONS ON DENGUE

DONALD A. CARSON
Commander (MC) U. S. N. R.

Dengue has become an important cause of absence from duty in the South Pacific combat area. Increased movement of troops between different islands, incidental to operations of war, has resulted in the appearance of dengue for the first time in various islands where it did not exist previously. Dengue had not been observed previously by the Colonial medical administration of the island of reference, although Aëdes mosquitoes are present. The introduction of patients having dengue, notably aviation personnel who frequently spend one or more nights at an adjacent group of islands, was sufficient to provide a source of infection for the vector.

Vector.—Aëdes aegypti has long been known to be a vector of dengue. Recently Aëdes albopictus has been shown to convey the virus, which introduces the possibility that other species of Aëdes are involved. In this location Aëdes variegatus var. hebrideus lives along with the better known aegypti and must be considered as a possible vector, although positive proof is lacking. Attention is drawn to this point because of the difference in the method of mosquito control. Aegypti mosquitoes propagate by laying eggs about the margin of water containers, such as tops of gasoline drums, empty tin cans, and cocoanut shells on or close to the ground; whereas variegatus var. hebrideus lays eggs in holes anywhere along the trunks of trees. Heavy rainfall provides sufficient moisture for larval development. The possibility of the latter species being a vector enormously complicates mosquito control as a preventive measure of dengue.

Epidemiology.—Experience with dengue at this activity has been characteristic of an epidemic disease that spares few of the population. The first case was recognized late in January. There was a fairly constant rate during February and March, and a marked increase in April and May.

The following shows the incidence of dengue, phrased in terms of percentage of total admissions by months:

	Percent
January	0.06
February	3.00
March	4.50
April	15.00
May	20.00

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The disease first appeared among aviation personnel in January and February, coincident with the finding of Aëdes mosquitoes by personnel of the Malaria Control Commission. It gradually spread to other groups and by April had become prevalent. In April and May, many of the admissions came from our own staff and from patients already admitted to the hospital because of other diseases. In the early part of the epidemic at least, this was due to ignorance of the fact that Aëdes mosquitoes bite by day as well as by night. Another factor was laxity among personnel in keeping fully clothed, making living quarters mosquito-proof, repairing tears in the insect screening of hospital huts, and restricting convalescent patients from attending the nightly moving picture.

Clinical features.—The onset of the disease is abrupt, with fever, prostration, malaise of a degree similar to a severe case of influenza, headache, pain on motion of the eyeballs, and complete loss of appetite. Nausea and vomiting often occur. Occasionally there is itching of the hands and feet, which is found more often in the milder cases. A chill seldom occurs, a point of some importance in differentiating dengue from malaria. The most characteristic feature of the symptomatology of dengue, as contrasted with other acute febrile diseases, is the pain referred to the eyes, which is aggravated by movement of the eyeballs. The complaint of severe aching in the spine and long bones, such as is suggested by the term "breakbone fever," was seldom found.

There is considerable variation in the physical signs. Listed according to the frequency of occurrence they are as follows: Saddleback fever, pulse rate not above 90 once the patient is at rest in bed, a maculopapular skin eruption, and enlargement of the superficial lymph glands. Pharyngitis was present occasionally. Rare signs are a palpable spleen and a third rise in the temperature curve. As in all epidemics, the cases varied from extremely mild to extremely severe, and the signs and symptoms (and leukopenia) varied accordingly. A few patients required morphine to obtain relief from symptoms.

Of all the physical signs a saddleback temperature curve is most characteristic. Some degree of saddling occurred in more than 77 percent of our cases. When the maximum temperature is only 100° to 101° F. this is not so easy to see on a chart, but when it is 103° to 106° F. the saddleback curve is unmistakable. Usually the initial fever is sustained into the 3d day of the illness, falling on the 3d and 4th days, rising on the 4th or 5th day and falling to normal after about 36 hours.

As a rule the second peak of fever is slightly lower than the first but occasionally the reverse is true. Spontaneous amelioration of symptoms accompanies the fall in temperature. A third peak of fever

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seldom occurred in our experience. When present it occurred on about the 9th or 10th day and was considerably lower than the preceding peaks. A pink to red maculopapular rash, involving the trunk and extremities occurred at some stage of the illness in 42 percent of our cases. It was seldom present on the 1st day. On the other hand we did not find it associated especially with the second bout of high fever as is often reported in the literature. The same observation applies to the enlargement of the superficial lymph glands which was noted in 35 percent of our cases. The cervical glands were enlarged more frequently than any other group of glands.

Laboratory observations.—A marked leukopenia is always found in severe cases. It is more marked than in malaria. The white blood count is usually below 5,000. The lowest count recorded was 1,800. In mild cases the count may be normal. Leukopenia continues into the first few days of normal temperature; blood studies were not continued beyond that point. There is nothing characteristic in the differential white blood cell count, the leukopenia being at the expense of the myeloid elements. There is no tendency to anemia. The urine is normal, not even "fever urine" being found. Reliance is placed upon leukopenia in making a diagnosis of dengue, and reluctance is felt in making the diagnosis in its absence.

Diagnosis.—There should be little difficulty in making the diagnosis in the presence of fever without initial chill, leukopenia, saddleback temperature curve, marked pain referred to the eyeballs, and absence of malarial parasites in the blood. The skin eruption, recurrent fever and pharyngitis may confuse dengue with measles, especially at the beginning of the epidemic, and exceptionally with scarlet fever.

There was difficulty occasionally in differentiating it from malaria, especially recurrent cases of malaria under suppressive treatment, in which the Plasmodium is difficult to find. Routine blood smears always should be made and should be repeated if the clinical picture remains indefinite. In a self-limited disease of short duration, such as dengue, the therapeutic test of quinine and atabrin does more harm than good and should be avoided until every other diagnostic measure has been tried. The temperature curve usually will settle the matter.

One patient was admitted to this hospital under a diagnosis of meningococcic meningitis who was found to have dengue, and one patient in whom the situation was reversed. The correct diagnosis was established within a few hours in each instance.

Course and treatment.—Dengue is self-limiting, relief from symptoms paralleling the return to normal temperature which usually occurs by the 6th day of the disease. There were no deaths and no serious complications. There was considerable weight loss but in the majority of patients this was regained as the appetite returned.

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Patients regained sufficient strength to be discharged to duty by the 10th to 14th day. Among the older patients strength and appetite tended to return less rapidly, but it was seldom found necessary to evacuate them for further convalescence. Neurasthenic symptoms were infrequently observed as sequelae.

Treatment was symptomatic. Aspirin and codeine controlled the discomfort of the majority of patients. Morphine was used rarely and only when symptoms were at their worst. It was helpful in cases of persistent vomiting, and such patients also received dextrose-saline solution intravenously. An attempt was made to stimulate those who were laggard in regaining appetite and strength during convalescence by the use of polyvitamin preparations.

CONCLUSIONS

Dengue has been found to be an important seasonal cause of disability in this part of the tropics. At least 2-weeks' absence from strenuous duty may be expected in the average case. Like malaria it is a preventable disease outside of combat areas, but only if the utmost is available in the way of mosquito control, mosquito-proof housing, and isolation of cases. If available the medical officers and corpsmen who take care of dengue patients should be those who are immune as a result of a previous attack. The clinical picture and differential diagnosis have been described.

THE Rh FACTOR

The advent of knowledge concerning the presence of a new agglutinogen in the red cells known as the Rh factor has further complicated the problem of transfusion. It is now well known that 85 per cent of people have the Rh factor, and that in the 15 per cent who do not there may be danger of their developing anti-Rh agglutinins when Rh positive cells are introduced into their circulation. There has been general acceptance of the work that erythroblastosis fetalis in the Rh positive baby born of the Rh negative mother is on this basis. Also, it is now realized that the administration of repeated transfusions to the Rh negative patient may be followed by a gradual building up of anti-Rh agglutinins with subsequent increasing intensity of reactions from transfused blood. Therefore, in the transfusion of whole blood it is necessary to determine whether or not such problems may arise in the patient being transfused and if so it is necessary that investigation of the Rh factor be made in order to avoid post-transfusion reactions on this basis. This means, of course, that facilities for determination of the Rh factor should be available in all institutions where transfusions are employed.—KRACKE, R. R.: Hematologic problems in general practice of medicine. South. M. J. 37: 90–96, February 1944.

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ACUTE INFECTIOUS JAUNDICE

JOHN H. WILLARD
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Acute infectious jaundice accounted for more than 750 admissions to this base hospital in a 6-month period. Although the mortality rate was nil, the morbidity due to this disease caused a serious loss in man-hours. The average patient was not ready to return to duty for at least 6 weeks. Because of this long period of convalescence many of the patients with jaundice were evacuated from this area.

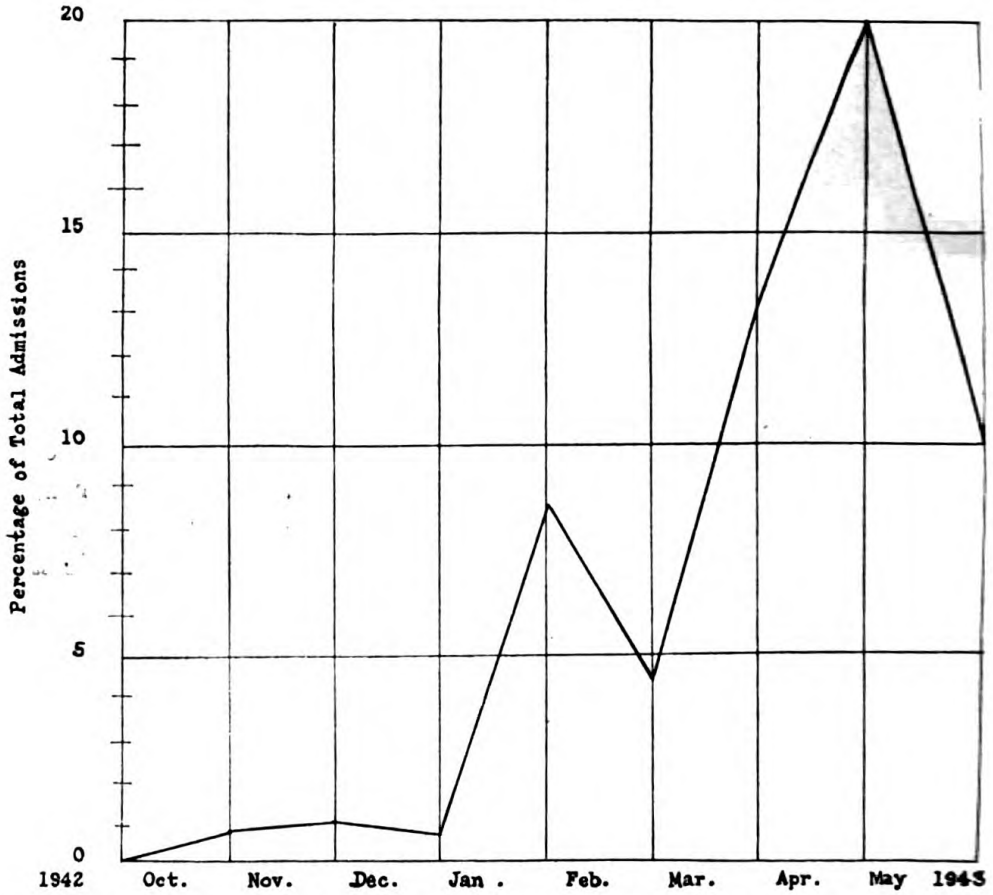
Although the general incidence of the disease is not known, its relative importance as a cause of hospitalization is shown in the accompanying graph. The first patient was admitted in October 1942, and the peak of admissions was reached in April 1943 when 350 cases were listed. The first patients admitted were Naval personnel from this section; later most of the patients came from troops stationed in or recently returned from adjacent areas. While epidemiologic data are not available, the disease seemed to spread by units. This was more noticeable in the early months when most of the patients came from only a few camps.

The occurrence of jaundice did not parallel that of any other infection. Gastro-enteritis not associated with icterus did not increase in those camps having a high jaundice rate. There was no correlation between the incidence of jaundice and malaria in the camps involved. The number of cases and the duration of disability seemed to bear a direct relationship to the state of nutrition of the men. Those who had had recurrent malaria or gastro-enteritis seemed to be more susceptible and the disease ran a stormy course. The disease occurred in others whose general condition seemed satisfactory and who had not been subjected to other infections. In some cases malaria may have been at least partly responsible for the jaundice; indeed, some cases of malarial jaundice may have been included. Acute malarial symptoms occurred infrequently, however, during the course of jaundice, and few positive smears were reported.

The onset was variable. Usually a prodromal period of several days with anorexia and malaise preceded nausea, vomiting, fever, and diarrhea. Occasionally these prodromal symptoms were absent, the illness beginning suddenly with backache, headache, chills, and fever. Nausea usually was present, and vomiting and diarrhea were not uncommon. Pain and tenderness in the upper part of the abdomen were complained of by some. Within 2 to 7 days dark urine and

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jaundice were noted. The clinical jaundice rapidly deepened during the first week, reaching its peak after about 2 weeks. Nausea and upper abdominal soreness usually began to decrease after the first week and gradually disappeared during the next 2 weeks.



Graph 1.—The relative incidence of acute infectious jaundice by months in percentage of total admissions.

There were, however, many exceptions to this typical course. Some patients had a mild and abortive illness with rapid recovery. In some the period of nausea and vomiting was short, whereas in others the gastric symptoms persisted for several weeks. Measurements of the degree of jaundice by means of the icterus index usually showed beginning decrease in from 10 days to 2 weeks. Pruritus was conspicuously absent and no hemorrhagic phenomena were noted.

Physical examination revealed no manifestations of importance in most instances except for the icterus of the sclera, mucous membranes, and skin. Many of the men in this locality have a deep atabrin pigmentation, but this color is never present in the sclera and mucosal surfaces and does not affect the icterus index reading. Failure to differentiate atabrin pigmentation from jaundice was, however, a cause of some confusion in early cases. Some upper abdominal tenderness, especially under the right costal margin, was not

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uncommon and the rounded, tender liver edge was occasionally palpated well below the ribs. Splenic enlargement was noted in some cases. The influence of recurrent malaria may have been important in this connection.

Laboratory facilities were limited, but most of the patients had at least one icterus index determination and many had repeated examinations. The average reading was between 25 and 50 units and was maintained at a constant level for about a week or 10 days. The highest readings approached 100 units. Blood counts were done on most of the patients and usually showed little deviation from normal. Urinalyses frequently showed small amounts of albumin in addition to the large amount of bile. Other liver function tests were not available.

Periodically an unsuccessful search was made for the Leptospira icterohaemorrhagiae. Urine specimens were collected during the second week of illness and the sediments were examined promptly. Guinea pigs were not available for inoculation. So far as is known no case of Weil's disease has been reported in this area.

Treatment.—The chief aim in therapy was to maintain adequate nutrition and avoid further impairment of the liver. For several days after onset, most patients tolerated only small amounts of liquids. Sweetened fruit juices constituted the chief source of calories during this period. Later soft foods were added to the diet, carefully eliminating fats. There was difficulty in obtaining the necessary amount of protein because most of the available meats were considered too fatty. Diluted condensed or evaporated milk, however, was tolerated well, either as liquid or as ice cream. Canned chicken was available at times and gelatin and vegetable purées were prepared occasionally. The patients were encouraged to eat hard candies but to avoid chocolate and nuts. Those with persistent vomiting received intravenous injections of dextrose and physiologic salt solution until oral feedings were retained. Multivitamin capsules were given when they were available.

No complications were observed, although the early evacuation of most of the patients precluded follow-up observations.

COMMENT

It is commonly believed that this type of jaundice is the same syndrome as acute catarrhal jaundice. Previous investigations of this disease have indicated that toxic hepatocellular impairment is the primary disturbance, although varying degrees of ductal obstruction may be present usually involving the smaller duct radicles. This may result in a combined retention and regurgitation jaundice and explains the Van den Bergh biplasic direct reaction obtained in most cases.

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The lack of complications, such as purulent cholangitis and liver abscess, argues against primary infectious involvement of either ducts or liver, as does the lack of demonstrable residual distortion or cirrhosis of the liver. The rapidity of resolution of the process would be unusual in diffuse inflammatory disease of the liver. It would appear that the primary change is a toxic one affecting the parenchymal cells—hepatosis rather than hepatitis. This hypothesis is supported by the presence of a positive galactose tolerance test early in the course of most cases of catarrhal jaundice as reported by many observers. This test is usually negative early in the course of purely obstructive jaundice.

Further evidence against primary bacterial infection of the biliary ducts has been reported by those studying cultures of bile obtained by transduodenal biliary drainage. These have been routinely negative for pathogenic organisms. Studies of liver tissue and bile for the presence of a virus also had yielded negative results in reported cases.

Clinical observation of the syndrome in the large group of patients at this hospital would suggest that the primary site of infection is the gastro-intestinal tract, for acute gastro-enteritis always precedes the appearance of jaundice. It seems likely that under conditions of poor nutrition, with consequent lowered resistance, and with chronic gastro-intestinal irritation induced by repeated attacks of gastro-enteritis and possibly favored by prolonged taking of atabrin, large numbers of men would succumb to an infection which under normal conditions would affect only a few. The poor hygiene and difficulties in maintaining sanitation under field conditions are added factors favoring the occurrence of catarrhal jaundice in epidemic proportions.

CONCLUSIONS

1. The high incidence of infectious jaundice proved an important cause of lost man-hours in the South Pacific area during a 6-month period. The average period of disability was 6 weeks.

2. The spread of the disease is favored by poor conditions of hygiene and sanitation in the field, and by the lowered resistance in personnel who have been subjected to repeated infections of other types.

3. No direct relationship could be established between this disease and malaria or various types of gastro-enteritis not associated with jaundice. Indirectly, however, these infections may condition the patient for this disease.

4. No serious complications or sequelae were observed in this series.

5. It appears that the jaundice is due to toxic changes in the hepatic parenchymal cells (hepatosis) rather than to an actual inflammatory hepatitis. Microscopic evidence supporting this hypothesis was not obtained owing to the lack of postmortem material.

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PSYCHIATRIC CASUALTIES

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Patients whose disabling symptoms were established as psychogenic in origin comprised approximately 5 percent of the total admissions to this hospital. Of 581 patients, 485 (83.5 percent) were classified as psychoneurotic, 7.25 percent as psychotic, 6.25 percent as constitutional psychopathic states, and 3 percent as miscellaneous. There were 5 cases of mental deficiency and 24 cases of epilepsy, which is in a different classification.

This small number of psychiatric cases is significant because many of these disabilities are permanent. Almost all these patients must be removed from the active war zone. Many patients evacuated because of malnutrition, fatigue, effort syndrome, neurocirculatory asthenia, gastritis, and peptic ulcer are actually psychiatric casualties.

All psychiatric symptoms are protective or useful. No patient with an obviously disabling wound or illness was observed with a psychosis or a psychoneurosis.

The average man experiences fear under fire or in any threatening situation. The normal, inherited physiologic preparation of the body for flight or fight occurs, and if the circumstances are not such that he can fight back or be usefully and busily employed, tensions develop. He becomes protective and contracts his field of interest. Fear of symptoms and preoccupation with them is more acceptable and legitimate to the person than fear of the external threatening situation.

The tensions mentioned are manifested in smooth muscle and in the muscles of the scalp, neck, and vertebral column, and result in complaints of headache, backache, gastro-intestinal symptoms, such as the common peptic ulcer syndrome, palpitation, pain about the heart, and other symptoms referable to the cardiovascular system. The complaint of fatigue and exhaustion may result from this misuse of muscle energy. These symptom complexes are typically psychoneurotic and usually increase gradually over a period of days or weeks. Hysteria or conversion hysteria and anxiety neuroses are apt to be sudden in onset and more quickly disabling. The diagnosis of anxiety state was made 24 times and of hysteria 32 times.

Of the psychoses 28 were classified as dementia praecox and 14 as manic-depressive. Excitement was the most frequent psychotic

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symptom, occurring 3 times as often in the manic-depressive group as did depressions. Catatonic stupor was the outstanding symptom in only 3 of the dementia praecox group.

The diagnosis of malingering was not made officially, but in the majority of cases there was an annotation to that effect. Experience here indicates that so-called malingering, as well as all psychiatric symptoms, is an attempt of a person to meet a situation, and under the circumstances, his best attempt. There is no sharp line of differentiation between a psychosis and a psychoneurosis, nor between a psychoneurosis and malingering. The reason for the symptoms or complaints as well as the goal is the same in all three types of reaction. The malingerer is fully aware of the mental process involved in attaining the goal, but the psychologic necessity of escape is just as real.

In all three types of reaction the presenting symptoms are useful and necessary so long as the person maintains the same opinion of himself and the same attitude toward his environment (the threatening or tedious situation). His symptoms are a necessary refuge. To remove the symptoms, thereby depriving him of his refuge, is to precipitate a more serious situation and force him into a more pronounced disorder. The mental attitude combined with the situation results in the symptoms. Punishment, ridicule, or humiliation results only in increasing symptoms or at best in delaying them for a short time.

Fear is sometimes expressed that "if this gold-bricker is allowed to get away with it"—that is, be hospitalized or evacuated—others will be encouraged to do the same thing. No incident has occurred here to justify this fear. As in other illnesses, a prepared host is necessary before the infective agent, in this case the threatening environment, can be effective. The host must have an attitude, not something new and changeable, but something that developed as he grew up. This attitude is not easily defined but basically is egocentric. The more concerned the person is with his own safety and comfort, without regard for the welfare of others or what he personally contributes to their welfare, the more pronounced is this attitude. Also the more he has depended for mental poise upon personal comforts and obtaining unearned praise, appreciation, and affection from others, the less able is he to maintain poise when placed where he cannot obtain special privileges and consideration.

Whether he develops a psychosis, a psychoneurosis, or malingering under the stress of warfare, he would hardly be able to do otherwise; he is probably less to blame for his response than are his parents and teachers. It is obviously unfair to disparage a man and label him a malingerer without inquiring into the past experiences which have conditioned him to act as he does. In each case the attempt has been

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made to determine the value of the man to the organization, and not to retain any man who would have to be considered a liability rather than an asset.

Rapid turnover made it impossible, in most instances, to spend the time necessary to develop insight and change of attitude in individual patients. The few patients with depression, who were given shock therapy (metrazol) with good results, and the hysterical patients who recovered from paralyses through suggestion, were not considered suitable for retention in the combat zone. Any person with an attitude that permitted disabling psychiatric symptoms to develop was not considered a good risk to remain in the area, especially as there is no limited duty status. An individual must be thoroughly well and capable of any assignment, or entirely ill and incapable of any duty.

Eventually more can be accomplished in preventive psychiatry by preparing officers and men for the changes to expect in themselves during actual combat, and to aid in developing a more stabilizing attitude. Possibly psychiatric counsel may be made available in combat areas where symptoms are apt to develop, an arrangement similar to that established by the flight surgeon with aviation personnel. Of help also in preventing maladjustment and psychiatric disabilities is the efficient placement of personnel in jobs for which they have special aptitude or training.

TRANSIENT NERVOUS HYPERTENSION

Transient nervous hypertension found at physical examination for naval service is evidence of a nervous pressor reaction and is often accompanied by one or more adrenergic manifestations, such as tachycardia, sweating, erection of hairs and disturbed rhythm.

Persons with transient nervous hypertension have a somewhat more marked rise of the blood pressure in response to cold than do normal controls, but definitely less than do patients with proved but mild early hypertension. The blood-pressure responses to exercise and to change in posture are not significant.

The familial predisposition to degenerative vascular disease, as indicated by the family histories of a fair sample of those with transient nervous hypertension, taken as a whole, appears less than in patients with definite essential hypertension.

The prognosis of nervous hypertension as indicated by a long follow-up study of 25 cases, regarding both mortality and morbidity before middle age, is excellent. ROGERS, W. F., and PALMER, R. S.: transient nervous hypertension, taken as a whole, appears less than sential hypertension. New England J. Med. 230: 39–42, January 13, 1944.

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RENIN AND ANGIOTONIN IN HYPERTENSION

In a hypertensive individual there is an increase in renin-activator and a decrease in renin- and angiotonin-inactivator, giving rise to an increased reaction to the pressor effects of renin and angiotonin. This starts a deadly cycle in which kidney damage gives rise to the production of renin, which in turn increases the blood pressure, which produces more kidney damage.

It may be stated, therefore, that available evidence indicates renin and angiotonin play a relatively unimportant role in the maintenance of normal blood pressure, but may play a considerable part in the maintenance of blood pressure at hypertensive levels.—MUSSER, D. C.: Hypertension; role of renin and angiotonin in maintaining blood pressure. New Orleans M. & S. J. **96**: 308–314, January 1944.

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DIFFERENTIATION OF CHICKENPOX AND SMALLPOX

There is no single feature, aside from specific laboratory tests, that can be relied on under all conditions to differentiate chickenpox and smallpox. The complete picture must be carefully studied. The patient, with the arms raised above the head, must be looked over from scalp to sole. Then the lesions must be closely examined. The rate and the manner of maturation of the lesions must be taken into consideration. The importance of realizing how mild smallpox can be has been pointed out. There is danger of relying too much on the presence or absence of "umbilication, shottiness, palatal and buccal lesions, lesions on the sole of the foot, cropping and uniloculation." Attention has been drawn to the fact that in chickenpox one may find one or more lesions resembling smallpox, and vice versa.—WESSELHOEFT, C.: Differential diagnosis of chickenpox and smallpox. New England J. Med. **230**: 15–19, January 6, 1944.

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A RAPID DETERMINATION OF INTELLECTUAL ADEQUACY FOR THE NAVAL SERVICE

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Lieutenant, junior grade H-V (S) U. S. N. R.

The inductees examined by the psychologists and psychiatrists at this station present a peculiar problem when a determination of their mental ability is desired. The reasons for this difficulty are: 1. Many of the recruits possess a language handicap which makes it difficult for them to express themselves in English even though they are able to understand the examiner. 2. Inasmuch as illiteracy per se is not considered a cause for rejection, some method had to be found for determining the intellectual ability of illiterate recruits without resorting to reading. 3. Many of the recruits are unable to write more than numbers or their own names. 4. The practical problem of time has to be considered, because the recruits have to be examined as part of a continuous physical examination.

For purposes of selection, all that is required is a quick estimate of intelligence which will classify a man as either mentally defective or not mentally defective. Only the men whose intellectual level seems questionable are tested. If found adequate, they are sent on to duty without further question. If, however, they are found lacking they are given further tests.[1]

Some test was sought, therefore, which could be administered and scored quickly, which required no reading on the part of the inductees and which required them to write nothing more than numbers or their names. Many tests were considered but were found unadaptable to our requirements. The device to be described here, entitled Differentiation Test, was constructed especially to fit the situation.

The subject is given an answer sheet on which he is to write his name, age, and number of school grades completed. Then there is read aloud a list of 14 questions, to which the answers in every case but one are numbers. The administration of the test requires approximately 5 minutes. The following is a copy of the test together with the time limits permitted for each question:

[1] Because time was short only 3 subtests of the Wechsler-Bellevue Scale were used: Similarities, digit span and arithmetic. WECHSLER, D.: Measurement of Adult Intelligence. Williams & Wilkins, Baltimore, 1941. p. 248.

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DIFFERENTIATION TEST

Question	*Time-seconds*
1. How many eggs are in a dozen?	5
2. How many minutes are in an hour?	5
3. How many quarts are in a gallon?	5
4. How many States are in the United States?	5
5. How many feet are in a yard?	5
6. How many sides does a square have?	10
7. If three lemons cost 5 cents, how many lemons can you buy for a quarter? (Repeat)	30
8. If you bought 9 cents' worth of candy and gave the man 25 cents, how much change would you get back? (Repeat)	20
9. How many days would it take you to shoot down 28 planes if you shoot down 4 each day? (Repeat)	30
10. How tall, do you think, is the average woman?	10
11. How many stripes are in the American flag?	5
12. How far do you think it is from England to the United States? About how many miles?	15
13. When is Abraham Lincoln's birthday?	15
14. (Digit span) 9–4–3–6–	(practice—not scored)
3–1–7–4–2 / 8–5–7–6–3	(either one correct)

This test was administered to 100 inductees together with the verbal portion of the Wechsler-Bellevue Scale. On the basis of an item analysis, the items were rearranged in order of difficulty with the exception of the digit span which was reserved for the final portion of the test, inasmuch as it required separate instructions. Next it was desired to find that point on the scale which would serve as a differentiation point between adequacy of intellectual functioning and inadequacy or suggested inadequacy.

TABLE 1.—*Results of test in 100 subjects*

Score on test	Number of inductees obtaining score	Wechsler-Bellevue Scale (verbal)					
		Defectives		Borderlines		Dull Normals or better	
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
		Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
14	0						
13	0						
12	3					3	100
11	4			1	25	3	75
10	16			6	62	10	38
9	16			11	69	5	31
8	19			16	84	3	16
7	15			14	93	1	7
6	13	2	15	10	77	1	8
5	5	2	40	3	60		
4	2	1	50	1	50		
3	4	4	100				
2	3	3	100				
1	0						
0	0						
Total	100	12		62		26	

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An inspection of table 1 will reveal the discrimination value of the test. Column 1 is the score on the test. Column 2 shows the number of recruits in the sample of 100 subjects obtaining those scores on the test. Columns 3 through 8 indicate the classifications received by these recruits on the verbal portion of the Wechsler-Bellevue Scale. Of these, columns 3, 5, and 7 show the number of recruits obtaining that classification, whereas columns 4, 6, and 8 give those numbers converted into percentages. The percentages have more significance because they show at a glance how the Differentiation Test and Wechsler-Bellevue Scale conform. The percentages of Dull Normals or better can be seen to decrease as the scores on the Differentiation Test decrease. The Borderlines increase, then decrease in a humped curve as the scores on the Differentiation Test decrease. The percentages of mental defectives can be seen to increase as the scores on the Differentiation Test decrease.

Although 12 percent of those tested scored below 65 on the verbal portion of the Wechsler-Bellevue Scale, it must not be assumed that 12 percent of the incoming recruits are defective. The indication is that of those referred for psychologic examination 12 percent were found to be inadequate intellectually. To present this more clearly, a sample of 5,787 recruits was taken. Of this number, about 4 percent were referred for psychologic examination, but of the entire group only about ½ of 1 percent were found to be mentally defective. Nearly 12 percent of the referrals, however, were mentally defective.

It must not be assumed that the men who did score below 65 on the verbal portion of the Wechsler-Bellevue Scale were summarily discharged from the service. It means only that these men were transferred to the neuropsychiatric service for intensive psychologic examination and further disposition, either to duty or discharge.

It will be observed, nevertheless, from table 1, that inductees scoring 8 or better on the Differentiation Test can be considered safely as being above the mental defective range, because in this category, in one category below it, and in all categories above it, none of the men tested by the Wechsler-Bellevue Scale scored as a mental defective. The percentage of men apparently who can be thus tested and classified in 5 minutes is 58. The group scoring 7 may be sent to duty without too much risk, thus bringing to 73 the percentage of referrals who can be tested and classified in little more than 5 minutes. The other 27 percent will require some additional testing.

In practice this procedure should serve to reduce the number of suggestive mental defectives and thus allow the psychologists more time for thorough examinations of other recruits.

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QUININE IN PLASMA

The intravenous use of quinine is often considered dangerous because a shock-like state occasionally ensues. However, in certain cases, which are mostly falciparum infections, this measure is essential to save life. Experience shows that circulatory collapse rarely results if the speed of injection is slow and the concentration of quinine is low. A medical officer recently suggested a possible further safeguard. He found that the fall in blood pressure was less and the results in general were better when quinine was given intravenously in blood plasma, rather than in saline solution. Since many of the patients who need this treatment may also benefit from plasma, this method merits further trial. The speed of injection should still be slow.—News and comment. Quinine in plasma for intravenous injection. Bull. U. S. Army M. Dept. No. 73: 13, February 1944.

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THE ANAL EXTERNAL SPHINCTER MUSCLE

The external sphincter muscle of the ano-rectal area is divisible into three portions, *i. e.*, it is a trilaminar muscle. This, together with the puborectalis portion of the levator ani, the outer longitudinal muscle of fascia, and the inner circular muscle of the bowel (internal sphincter), forms a strong muscular cylinder encircling the lower rectum and anal canal. In other words, the external sphincter is not the superficial subcutaneous single muscle so often referred to in textbooks, but is actually a strong muscular cylinder completely encircling the anal canal and the ano-rectum, which at its uppermost level joins with a portion of the levator ani to enter into the formation of the ano-rectal ring. The three components of the sphincter ani externus muscle are: (1) sphincter ani externus subcutaneous; (2) sphincter ani externus superficialis; (3) sphincter ani externus profundus. Fibromuscular septa from the fascia of the outer longitudinal muscle of the rectum actually separate and divide off the three portions of the sphincter ani externus. DANIELS, E. A.: Ano-rectal suppurative disease and ano-rectal fistula. Canad. M. A. J. 50: 147–154, February 1944.

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SCHIZOPHRENIA IN THREE BROTHERS

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Roberts [1] in 1940 reported the case of three brothers, ranging in age from 41 to 45 years, who were admitted to a Veterans' Administration Facility within a period of 21 months, each with a diagnosis of schizophrenia, with paranoid ideas being the predominant features. It is the only case of this kind described in American journals in the past 20 years. This article presents similar schizophrenic psychoses in three brothers, aged 17 to 21 years, all service cases, admitted to St. Elizabeths Hospital within a period of 37 months.

The information contained in this article was obtained for the most part from the mother of these patients during her frequent visits to the hospital. There was an effort on the part of the mother to minimize the environmental factors in her boys' illnesses, for in being over-protective, she attempted to distort facts and smooth over many highly significant details in their personal history. Each time the Red Cross worker called at her home, for example, following the admission of one of her boys to this hospital, she denied any previous nervous or mental illness in the family.

All three boys were born and reared in a town of 12,000 population, in which the chief industries are textile and pulp mills. The family has always lived in the mill community in the same house, one of a large group of frame bungalows surrounding a textile mill. The community is located one block from the river. It has a school for the mill families as well as a recreational and social center for its employees. Almost everyone in this community works in the mill. Young girls and boys, after having completed their education, join their parents in the same occupational pursuit. The mill provides hospital and medical care for the employees at a small monthly rate.

The mother of these patients is 43 years old and was born in a small nearby farming community. Her schooling ended after the 7th grade when she began working in a mill. At the age of 15 she married a mill hand who was 26 years old. Except during child-bearing, she worked continuously in the mill up to the present date.

At present the mother is in good health and asserts that there was never any mental or nervous disease in the family. She is fearless,

[1] ROBERTS, A. L.: Three schizophrenic brothers. M. Bull. Vet. Admin. 16: 278–279. January 1940.

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outspoken, and obviously domineering over her husband and children. In the crowded visiting room at this hospital, she does not hesitate to raise her voice, shouting at the physician passing through, "Hey you, come here." She seems devoted to her boys and freely admits babying them and demanding their affection. She is entirely without understanding as to the implication surrounding her sons' hospitalizations, for she seems proud of their being at the well known" St. Elizabeths Hospital. She is at a loss to explain how her "perfectly normal" boys, in chronologic sequence, could have developed "nervous breakdowns."

The father always worked in textile mills and apparently was a meek and ineffectual person, never in very good health and having little to do with the upbringing of his children. Because of illness he left the mill in 1933 and became a guard at a State prison farm, 22 miles from home. He visited his family every other weekend. He continued this type of life until his death in 1941 after 1-week's illness following a stroke. He was 52 years of age.

The family consists of 4 children; the oldest a daughter, aged 26, is married and has 2 children. The other three children are boys, 23, 20, and 17 years, respectively. The mother apparently had normal pregnancies and uncomplicated labor, and was always attended by the mill physician. All children were breast-fed and their early development was similar and unmarked by serious illnesses or accidents. The grandmother, until her death in 1929, lived with the family, helped rear the children and ran the house while the mother worked at the mill.

The children were all compelled to attend school until they were old enough to go to work in the mill. They were taught early to assist with the housework and help with the cooking and baking. The boys were frequently truant from school and they would attend movies or hang around the streets until after school hours. All three boys failed in their school work, although this is denied by the mother. The family attended church regularly and all the boys went to Sunday school until late adolescence.

When the children were young they all slept in the back room where the grandmother also slept. The middle room was occupied by the parents. When the father left home in 1933 the youngest child began sleeping with his mother and continued to do so up until his entry into the Navy. When the father would come home, they either slept three in a bed or the boy slept on the floor. In discussing this sleeping arrangement the mother is reluctant to accept this condition as other than normal and socially acceptable, and she further states that her son never wanted to sleep in a room alone.

The oldest brother, the first to be admitted to this hospital, was born on 26 April 1919. His birth and early development were essentially normal.

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he usual childhood diseases were contracted. He entered school at the age f 6 and finished the 6th grade at the age of 14. His teachers described him as ow, lazy and uncooperative. His intelligence quotient at that time is said have been 84. Two years after he left school at the age of 16, he obtained is first real job, working in the local mill, at first at manual labor but pro- ressing to timekeeper and office assistant. He maintained an excellent record or about 4 years and is said to have got along very well with his family, busi- ess associates and friends.

He had many intimate friends, some of them of long standing. He displayed o sex preference and was well liked by both sexes. He enjoyed all types of utdoor sports, read little, occasionally danced and played the guitar. He has ever been arrested and his habits were temperate. He was single but had gone teadily with a local girl for 2 years. He denied heterosexual or homosexual elations. He admitted masturbation from childhood and had continued the ractice almost daily up until his admission to this hospital.

He enlisted in the Marine Corps 6 May 1940 supposedly because of a desire to arn electrical engineering. Four days after his enlistment, on 10 May 1940, e developed some type of collapse in the barracks and was admitted to the sick st complaining of headache, nervousness, and a feeling of numbness all over is body. He admitted having had these spells in the past prior to enlistment nd said that they came on whenever he became excited or was in strange sur- oundings. He was correctly oriented at that time and presented no delusions, allucinations, or illusions. Physical and neurologic examinations were essen- ially negative at that time.

During this hospitalization the patient exhibited odd behavior and expressed any bizarre ideas. On 17 May 1940 he asked another patient to take a butcher nife and kill him. He said he had no reason for living. He became confused nd thought he was in hell. He was completely disoriented. On 21 May 1940 e was transferred to the U. S. Naval Hospital, Washington, D. C., where he was nute, totally inaccessible, and performed stereotype movements. He was de- tructive and refused food. He assumed postural states and attitudinizing posi- ions, and was negativistic and emotionally flattened. In this condition the pa- ient was transferred to St. Elizabeths Hospital on 21 May 1940.

On admission the patient was mute, rigid, negativistic, and entirely inacces- ible. He refused to open his mouth or put out his tongue. He did not respond o pain stimuli but he showed no waxy flexibility. Again physical, neuro- ogic, and laboratory examinations were negative. The mental examination evealed psychomotor retardation, intrapsychic blocking and total lack of in- ight and judgment with emotional flattening and complete disorientation. Hal- ucinations and delusions and ideas of reference could not be obtained. Gen- ral intelligence was in accordance with his low educational level. The diagno- is was established as dementia praecox (schizophrenia), catatonic in type.

During his course in this hospital at first the patient had to be tube-fed regu- arly, but after 2 weeks he began to show slight improvement. Convalescence was gradual and the patient was finally discharged into the custody of his fam- ily on 20 October 1940 as a social recovery, having had approximately 5 months of hospitalization. On discharge, it was noticed that there still remained slight psychomotor retardation and emotional dulling, with a tendency to indo- ence, not sufficient to interfere with a simple occupational adjustment. Ac- ording to the mother, the patient obtained a job within 3 weeks after discharge rom this hospital.

The second of this trio was born 28 June 1923. His birth and early devel- pment were normal except for some early difficulty in speech which was

corrected by the removal of tonsils and adenoids. He had had the usual childhood diseases without complications. He began school at the age of 6 and discontinued in the 6th grade at the age of 14 to join a CCC camp. He had done poorly in school and had repeated the 5th grade. He frequently got into trouble with other boys and had many fights. He spent 2 years in the CCC camp and then was employed in the same mill where his older brother worked. In a short time he returned to the CCC camp, which he preferred. His relationship with his employer and coworkers was said to have been good.

He was quick-tempered and could not tolerate teasing but did not indulge in sullenness, crying or anger. He was happy-go-lucky, careful in his appearance. He never had any special girl friend but would often go with a group of boys and girls. He had one particular boy friend with whom he constantly associated up until his entry into the Navy. This friend is described as a quiet boy who seemed to enjoy his company as the life of the party, although without showing off or seeking to be the center of attraction. He was arrested once for drunkenness associated with disturbance of the peace.

He joined the Navy in July 1941 for patriotic reasons and his letters home displayed a liking for the Navy. He got along fairly well, although he got into fights with his shipmates and drank considerably when on shore leave. Early in December 1941, while on board ship the patient began to feel "dizzy and turned around." He thought that his superiors were discriminating against him and that his shipmates were swearing and saying bad things about him. He became irritable, got into several fights and refused to carry out orders. He reported to the sickbay on 10 December 1941 and was admitted to a Naval hospital on 11 December 1941, where he was mute, retarded, seclusive, self-preoccupied, and had ideas of reference and paranoid delusions. He said his food was doped and he exhibited inappropriate smiling. No hallucinations could be elicited. On 23 December he was transferred to Washington, D. C., where his condition remained unimproved and on the same date he was transferred to St. Elizabeths Hospital.

On admission here the patient was emotionally flattened and his production meager, though relevant and coherent. He denied hallucinations and delusions. He was markedly disoriented and confused. Memory for recent and remote events was impaired. General intelligence and knowledge were poor. At the admission conference a diagnosis of dementia praecox (schizophrenia), catatonic in type was made. The patient adjusted well to hospital routine, and recovery was rapid. On 27 February 1942 he was correctly oriented, and insight and judgment had improved. On 29 May 1942 the patient was discharged into his own custody as recovered. At the present time he is again working in the textile mill at home and has several times tried to re-enter the Service. His mother states that he is extremely resentful of any remarks concerning his patriotism.

The third brother admitted to this hospital and the youngest member of the family was born on 13 June 1926. His birth and early development are said to have been normal. He had had a mild attack of diphtheria at the age of 3. He began school at 6 and failed the 1st, 3d, and 4th grades. He finally left school in the 8th grade at the age of 16. He was enuretic until the age of 14 and walked in his sleep and had nightmares for many years. The mother states that he never "went with girls or drank a drop or cursed an oath." He played baseball and football but preferred to be alone. He liked to fish and hunt and as he grew older his mother took him to the dances at the mill but he never took part in them. He spent most of his spare time at the moving pictures. He began to masturbate at the age of 12 and indulged

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ial masturbation and fellatio up to the week of his entry into the Service. the summer he worked in the mill and after he left school he was em- there until he entered the Service.

nlisted in the Naval Reserve on 15 June 1943, and reported for active 16 June 1943. Immediately he became nervous and homesick and could ep. He was first seen in the sickbay on 25 June following a typhoid in- on and was found to be homesick. After reassurance and encouragement, rned to his company. On 28 June he was returned to the neuropsychiatric y his company commander, because he was increasingly agitated and dis- On admission there he complained of a "Yankee cold" and he presented us somatic complaints. On one occasion he insisted he was going to have and he asked that a doctor be called. He was extremely agitated and ensive and asked, "Are they going to scare me to death or are they going me?" He admitted auditory hallucinations; that is, hearing his mother's the barracks and hearing God's voice. His somatic delusions were as : "I ain't got no blood. I'm rotting away inside. I ain't got no nerves. els won't work." A diagnosis was made of dementia praecox. The patient nsferred, on 2 July 1943 to the Naval Hospital, Bethesda, and on 5 July mitted to St. Elizabeths Hospital.

dmission the somatic complaints persisted. The patient stated that his vas bad, he felt "like glass in his stomach, his bowels were too full, and vas smoke in his kidneys. He was rotting away with tb." He said hones had been concealed in his room, so that he could hear voices talking im, those voices being accusatory in nature. His facial expression was d he appeared emotionally let down. He said that the doctors thought a spy and had "put him on the hot seat." Physical and laboratory exami- were essentially negative. He was found to have a mental age of 11 nd to be of borderline intelligence. A diagnosis was made of dementia (schizophrenia), catatonic in type, at the admission conference on 12 July. patient has now been in the hospital for almost 3 months and there has ly slight improvement in his condition since his admission. Occasionally arful and worried about his physical condition and he takes the blame er patients being sent off the ward. On 3 August he was depressed and and threatened to kill himself. He believes that his home state has been by the Germans and he was certain that his mother was dead until she him recently. He was discharged from the Navy on 21 August 1943.

SUMMARY

ilar psychoses in three brothers is an unusual occurrence. That ses in brothers and sisters and in twins tend to be identical is stablished. This article reports the case of three brothers, all men, admitted to St. Elizabeths Hospital, Washington, D. C., a period of 37 months. In considering the psychogenesis of ases, the following facts are interesting:

he apparent lack of well-defined psychoses in the antecedents.
he low intelligence quotient of each patient.
he acute onset with the rather rapid recovery.
he role of military service as a precipitating factor.
he catatonic reactions as the predominant feature in all.

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EPULIS

"Epulis," meaning a tumor of the gums, is applied only to benign tumors. Histologic grouping of these tumors shows them usually to be a fibroma, osteofibroma, angioma, angiofibroma or giant-cell tumor. Both local and general etiologic factors must be considered in the production of these lesions, with malocclusion prominent. Treatment is best accomplished by surgical removal of the tumor tissue and adjustment of the occlusion by grinding the teeth, if the case is not too far advanced. Otherwise, extraction of adjacent teeth is indicated.—SOLOMON, H. A., and BURKE, E. M.: Epulis; report of fatal case. J. Am. Dent. A. 31: 237–241, February 1, 1944.

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ANOXIA EFFECTS ON MYOCARDIUM

Histologic changes were observed in the myocardiums of animals which were subjected to prolonged systemic deprivation of oxygen over periods of three or more days. An endeavor was made to keep the concentration of oxygen near 4 to 5 per cent.

The myocardial lesions produced by deprivation of oxygen resembled those found in the heart after the administration of toxic doses of digitalis. They were focal in distribution and were most prominent in the papillary muscle and in the left ventricular wall.

Cellular changes were also observed in the central nervous system after prolonged deprivation of oxygen.—DEARING, W. H.; BARNES, A. R.; and ESSEX, H. E.: Experiments with calculated therapeutic and toxic doses of digitalis: VI. Comparative effects of toxic doses of digitalis and of prolonged deprivation of oxygen on electrocardiogram, heart and brain. Am. Heart J. 27: 108–119, January 1944.

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SYNCOPAL REACTIONS OF ANOXIC SUBJECTS OBSERVED IN THE LOW PRESSURE CHAMBER

RELATIONSHIP TO THE INCIDENCE OF EPILEPSY
PRELIMINARY REPORT

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During routine indoctrination at some Naval altitude training units, aviation personnel are exposed to a simulated altitude of 18,000 feet without oxygen for a period of from 14 to 16 minutes. Of 2,798 men undergoing this routine procedure at one station, 6.5 percent developed marked syncopal reactions, 0.9 percent losing consciousness. Often the first indications that these individuals are experiencing difficulty are fixed facial expression, complete loss of interest in what is being done, a grayish-yellow pallor, profuse sweating, and a slow and sometimes imperceptible pulse. These subjects are given oxygen as soon as the symptoms are detected and most of them recover without losing consciousness.

In other cases the onset of symptoms and collapse is so sudden that the subject loses consciousness either before oxygen can be administered or from 30 to 60 seconds after starting to breathe oxygen. These men usually regain consciousness in from 1 to 3 minutes; however, the pulse usually remains slow, perspiring continues, and normal coloration does not return for 15 to 60 minutes. It is believed that all these subjects would collapse if allowed to continue without oxygen.

During the last war a large number of men were given an altitude classification test in which they rebreathed air until the oxygen tension was reduced to such an extent that either physiologic or psychologic collapse occurred or was imminent. They were divided into "fainters" (46.7 percent) and "nonfainters" (53.3 percent) (*1*) (*2*). The "fainters" were those in whom the cardiac, respiratory, and vasomotor centers were paralyzed before the higher psychic centers col-

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lapsed; whereas in the "nonfainters" the psychic centers failed before the physiologic mechanisms. The "nonfainters" continued to sit erect and the respiratory, cardiac, and vasomotor centers continued to function for a short time after consciousness was lost. As a group the "nonfainters" tolerated anoxia better than the "fainters." It is known that some tolerate anoxia better than others and many explanations have been offered for these variations (*3*).

During the current altitude indoctrination program there has been a tendency to think of subjects who collapse on short exposure to 18,000 feet as "fainters." Those who experience difficulty at this altitude but recover after oxygen has been given without loss of consciousness are often termed "nonfainters." The routine syncopal reaction with and without loss of consciousness at 18,000 feet seems to be the same. Apparently among the ones who do not "faint" the reaction is not so sudden and they are given oxygen in time to prevent collapse. Most can tolerate 18,000 feet for 15 minutes without collapsing; therefore the extreme susceptibility of some to anoxia must be due to some underlying pathologic or physiologic condition.

Lennox (*4*) has shown that alkalosis produced by hyperventilation or anoxia produced by oxygen concentrations of less than 10 percent will often produce an attack in subjects with "petit mal" epilepsy. During ascents in low pressure chambers both rate and depth of respiration is increased (*3*) (*5*). The carbon dioxide content of the alveolar air at 18,000 feet is sometimes decreased to approximately 30 mm. Hg., producing alkalosis. At this altitude the oxygen saturation of arterial blood is reduced to from 65 to 75 percent. Because these conditions are adequate for producing attacks in individuals with epilepsy and because of the similarity of the syncopal reactions to those described by Gibbs, Gibbs and Lennox (*7*) for psychomotor or epileptic equivalent subjects, it was decided to investigate these severe anoxic reactors more thoroughly. Ten subjects, all early reactors to anoxia, five of whom had lost consciousness and five who had recovered without loss of consciousness after oxygen had been administered, were selected for study.

These subjects ascended to 18,000 feet (379.4 mm. Hg.) at a rate of 4,000 feet per minute after a drop from 5,000 to 2,000 feet to test the patency of the eustachian tubes. Ventilation was maintained through the chamber to prevent an increase in the oxygen concentration. At the first apparent signs of a subject collapsing oxygen was administered.

After the chamber run was completed a history of the failing subject was taken and every effort was made to obtain any past history of epilepsy or head injury. Routine clinical blood and urinalyses were made. From 1 day to 2 months later an electrocardio-

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electroencephalogram and a glucose tolerance curve were The electroencephalograms were made on a single channel ıe in the neurosurgical department of a Naval hospital. They ıade, read and interpreted by an independent investigator who knowledge of the severity of the anoxic reaction, history of ɔject, or other clinical findings. The glucose levels were de-ed by the Folin-Wu method on venous blood.

his basis of the electroencephalogram a diagnosis of epilepsy be made in the first 5 cases in table 1. Cases 6 and 7 would be ed as doubtful epilepsy. In cases 8 and 9 there were abnormal ncephalograms. In case 10 there was a normal electroenceph-n but a history of head injury and of fainting in the family.

—*Showing relation of symptoms during syncopal reaction in low pressure mber at 18,000 feet to history and EEG patterns indicating epilepsy*

Age	Flying hours	Past history indicative of epilepsy	Time at 18,000 feet (minutes)	Symptoms during collapse at 18,000 feet			Electroencephalographic interpretations
				Loss of consciousness	Convulsions	Slow pulse, pallor, and perspiration	
22	0	Fainting	8	Yes	Yes	Yes	Dysrhythmia of epileptic pattern.
23	30	None	8	No	No	Yes	Dysrhythmia suggestive of epileptic pattern rt. frontal lobe and increased beta patterns both temporal lobes.
23	100	Frequent headaches	4	No	No	Yes	Dysrhythmia rt. frontal and both temporal lobes with suggestions of epileptic tracing rt. frontal area.
19	0	Fainted often as child. Frequent headaches.	8	Yes	Yes	Yes	Dysrhythmia rt. frontal lobe suggestive of epileptic pattern.
36	30	Fainting and convulsions.	0	Yes	Yes	Yes	Generalized dysrhythmia suggestive of grand-mal type.
22	900	None	8	Yes	No	Yes	Dysrhythmia rt. frontal and both temporo-parietal lobes.
21	70	None	8	Yes	No	Yes	Dysrhythmia left temporal and parietal lobes slightly suggestive of epileptic patterns.
19	10	Head injury	8	No	No	Yes	Increased beta waves left temporal lobe.
19	5	None	6	No	No	Yes	Increased beta waves both temporal lobes.
21	0	History of head injury. Father is "fainter".	4	No	No	Yes	Normal.

ıe 3 men who lost consciousness at 18,000 feet and had convul-ıll would be classified as epileptic on the basis of the electro-alographic observations. In case 5 there was a history of epilep-ıcks; in case 1, an attack at the time the electroencephalograph ıes were being applied, and in case 4, frequent headaches and

a history of having fainted easily until the age of 10. All the glucose tolerance curves except that of case 2 were low and flat. This one discrepancy is explained by the patient's having consumed a package of mints shortly before the initial fasting blood sample was drawn. All the curves are indicative of central nervous and allied disorders that tend toward epilepsy.

Though 10 cases are inadequate for conclusions, these results indicate that all flight personnel experiencing severe syncopal reactions on short exposure to 18,000 feet without oxygen, should be carefully studied for central nervous system disorders. This is especially true of those who lose consciousness and have convulsions. Most of these reactions are probably subclinical and the attack is produced only by the strain of the moderately severe anoxia.

SUMMARY

1. Typical early syncopal reactions induced by anoxia in the low pressure chamber at 18,000 feet during from 13 to 16 minutes' exposure are described.

2. Ten of these typical cases were thoroughly studied. The clinical results obtained indicate that a high percentage of this type of subject have disorders of the central nervous system which tend toward epilepsy.

3. Syncopal reactions observed during short exposure at 18,000 feet probably cannot be differentiated into "fainters" and "nonfainters."

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PROTRUDED INTERVERTEBRAL DISC

ADVANTAGE OF THE UPRIGHT POSITION IN SURGICAL REMOVAL

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Lieutenant (MC) U. S. N. R.

The surgical removal of protruded intervertebral disc has made much progress from a technical point of view. Simplification in method is apparent. The possibility, however, of further improving the surgical procedure by altering the position of the patient has received little attention.

When the syndrome first became accepted as a clinical entity the usual surgical approach was an extensive bilateral laminectomy. Gradually the operation became less radical until today a hemilaminectomy, or even a partial hemilaminectomy, is considered the procedure of choice. Frequently it is possible to remove the protrusion after resection of the ligamentum flavum without the sacrifice of any portions of the laminae.

Wide experience and proper correlation of clinical and surgical findings has led to greater accuracy in diagnosis. It is no longer sufficient merely to establish the presence of a protruded disc. The exact localization can and should be possible in most instances by careful consideration of reflex changes, location of pain, sensory disturbances and motor weakness. Clinical accuracy has improved to such an exteht that many surgeons now favor direct exploration without recourse to the preoperative use of contrast media.

The use of contrast media, which was once considered an essential part of every investigation, is now generally reserved for those patients in whom the presence of a disc cannot be established by other means. The early enthusiasm for contrast media has lessened because of certain technical disadvantages and limitations of the method.

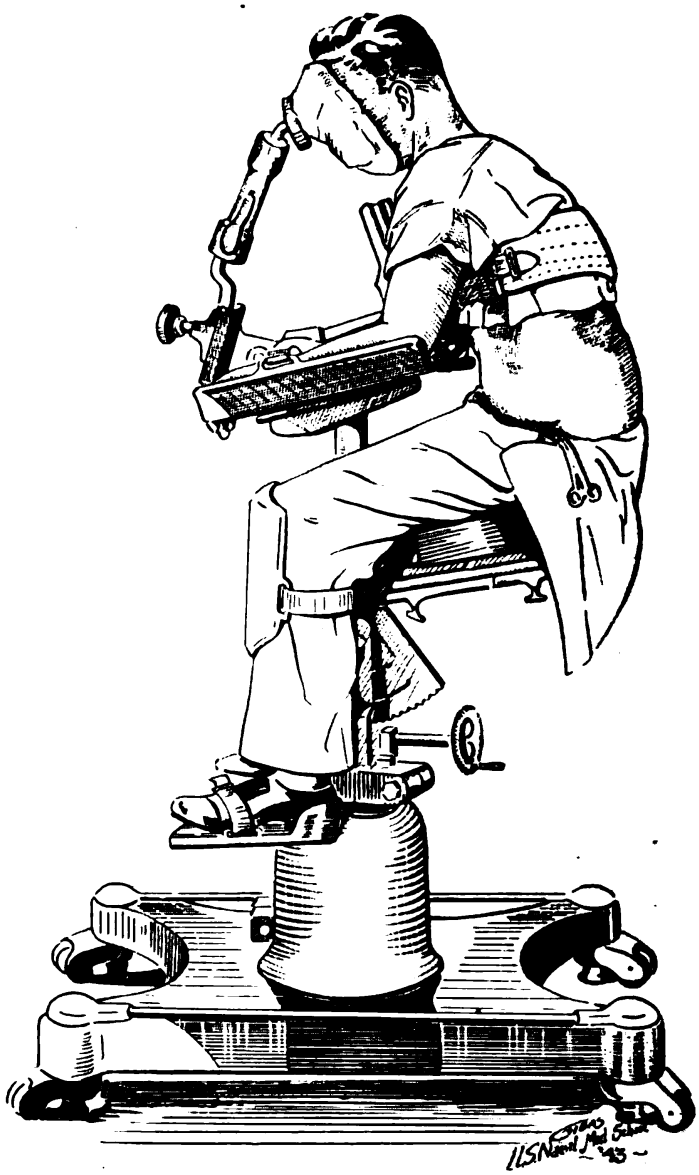
Methods of anesthesia have likewise been subject to changes and improvement. Ether, avertin, and local anesthesia were commonly employed during the early days of disc surgery. Reduced operating time has allowed the use of spinal anesthesia which affords improved exposure through maximum muscular relaxation. Recently continuous spinal anesthesia has been employed to excellent advantage.

The position of the patient is an important consideration. The

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usual horizontal prone position has proved adequate for satisfactory removal of the majority of lesions but it also imposes technical disadvantages upon the surgeon which can be overcome by placing the patient in the upright position.

This position has been employed in neurosurgery for many years, but its use has been limited chiefly to operations in the suboccipital



1. Position of patient for operation.

and cervical regions. The advantages are obvious to those who have had the opportunity to compare the ease of operation and increased visibility of a suboccipital craniotomy done in the upright position with a similar operation done with the patient in the horizontal position. So far as is known no one has yet attempted to apply

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this principle to the removal of the protruded intervertebral disc.

An operating chair was designed in which the patient could be placed in a sitting position (fig. 1). The operating chair combines simplicity and ease of adjustment. The tubular steel construction affords strength and at the same time allows adequate adjustment. The patient sits on the seat, rests his body on the chest piece and head in the face rest. The feet and legs are placed in the adjustable metal stirrups. The chair has a regular hydraulic operating base. A worm gear type of adjustment allows the patient to be placed in any desired position, from the sitting to the horizontal, without interfering with the operative procedure.

The chair was originally planned for use in operations in the suboccipital and cervical regions but seemed to lend itself equally well to operations for ruptured intervertebral discs in the lumbar area. The adaptation proved very satisfactory and revealed several distinct advantages as compared with the usual horizontal position.

Ease of operation.—With the patient in the sitting position the chair can be elevated so that the surgeon can stand erect and operate in a more comfortable position.

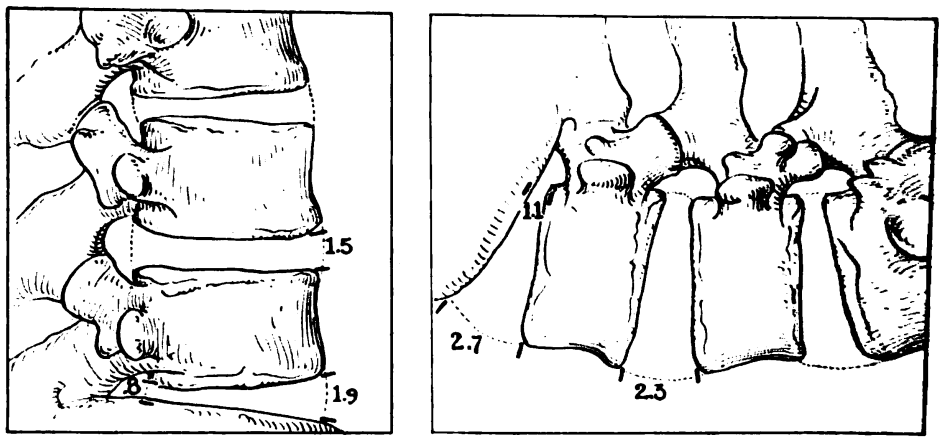
Increased visibility.—The operative field at eye level allows improved visibility for both the surgeon and assistants. The pathologic lesion may be demonstrated to others present in the operating room with greater ease and less fear of contamination. Gravity prevents blood from collecting about the lesion, thus greatly reducing the necessity of suction. The hydrostatic effect of the vertical column of cerebrospinal fluid within the dural sac applies equal pressure on the venus plexus above and below the site of exposure, thus reducing the degree of extradural bleeding. The space between the laminae is increased due to the forward flexion on the vertebral column. This affords greater visibility with minimal removal of bone.

Degree of protrusion.—A year ago, after the first few patients had been operated upon in this position, the impression was gained that the average degree of protrusion was greater than in patients in the horizontal position. Subsequent experience with this method tends to substantiate this original observation.

The explanation for the greater size of the protrusion is probably mechanical. The increased weight of the trunk and head tends to compress the disc. The flexed portion of the vertebral column in the upright position, exaggerated by complete muscular relaxation, favors greater compression of the anterior portion of the disc (fig. 2). These factors acting together provide the ideal mechanical advantage for maximum posterior protrusion of the affected intervertebral disc.

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Postural hypotension was considered a contraindication to the upright position, but it has been demonstrated conclusively (Craig) that if the legs are wrapped with ordinary cotton bandages before surgery



2. Diagrammatic representation of intervertebral distances taken from roentgenograms of patient in upright and prone position.

the blood pressure will remain constant. Spinal anesthesia can be used effectively provided an agent is employed which is heavier than spinal fluid. Pontocaine hydrochloride with dextrose has proved satisfactory for this purpose.

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RED CELLS IN WOUND DRESSINGS

In the processing of blood plasma over half of the whole blood withdrawn is discarded. It occurred to the authors that this red cell discard might serve a useful purpose as a wound dressing for raw and potentially infected surfaces, and the first clinical usage of the product included a case of a knee joint arthrotomy, extensive burns of both lower extremities, postoperative infections, and two resistant ulcers of the leg. The striking features appear to be the following: (1) Subsidence of purulent secretion; (2) smooth healthy granulations; (3) impervious veneer coverage preventing fluid loss and re-infection; (4) painless application, and (5) conversion of a waste product into a useful agency.

Several theories to explain the results obviously present themselves. Perhaps it acts as an occlusive and reduces oozing and re-infection. The very high protein content of the material may play a rôle. There may be some specific element which in this concentrated form is of value; or the products of destroyed and disintegrated cells may stimulate cell reproduction. Certainly leucocytes as living functioning phagocytes have disappeared, and likewise plasma with its contained antibodies are absent.—MOORHEAD, J. J., and UNGER, L. J.: Human red cell concentrate for surgical dressings Am. J. Surg. 59: 104–105, January 1943.

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DERMATITIS VENENATA CAUSED BY SEMECARPUS ATRA

JOSEPH M. HITCH
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During the past year a severe dermatitis venenata resulting from contact with a tree (Semecarpus atra) known in certain South Pacific islands as acajou, pomme d'acajou, goudronnier or nolé has been repeatedly observed. Approximately 25 patients with this condition have been seen in the dermatologic service of U. S. Naval Mobile Hospital No. —— and many more cases have been brought to our attention.

Botanical information is difficult to obtain in this area and one cannot be certain that all of the local names given refer to the same species. However it appears assured that the tree under discussion is the Semecarpus atra which is native to New Caledonia, the Loyalty Islands, Isle of Pines, and the New Hebrides group. This tree belongs to the Anacardiaceae family notorious for members which are violently irritating to the skin.

Livingood, Rogers and Fitz-Hugh [1] and Goldsmith [2] reported cases of dermatitis venenata caused by contact with a laundry marking ink which is obtained from the bhilawanol, ral, or bella gutti tree (Semecarpus anacardium). Some other members of the Anacardiaceae are the rhus plants of North America, the mango, the Chinese lacquer tree (Rhus vernicifera), the West Indian cashew, the Oriental cashew, and the kau karo or itchwood (Onocarpus vitiensis) of the Fiji Islands. An interesting sidelight on the disastrous effects of this last-mentioned tree was recorded by Seeman in the nineteenth century as follows:

> Mr. E. A. Egerstrom, a Swedish gentleman, residing on the island of Naigani, had been still more unfortunate in his accidental contact with the Kau Karo; and on visiting his hospitable roof on the 2nd July, 1860, he was just recovering from the effects of the accident. Having desired a native carpenter to procure him a spar suitable for a flagstaff, one was brought of Kau Karo, about 42 feet long and 22 inches in girth at the foot, having a white wood and a green bark, not unlike that of the Vaudina (Hibiscus tiliaceus) Linn., and light-coloured when peeled off. Ignorant of the poisonous properties of the tree, Mr. Egerstrom himself peeled off the bark, and found the sap beneath it very plentiful. "In the evening,"—I quote Mr. Egerstrom's own words, in a letter to the British Consul—

[1] LIVINGOOD, C. S.; ROGERS, A. M.; and FITZ-HUGH, T., Jr.: Dhobie mark dermatitis, J. A. M. A. **123**: 23–26, September 4, 1943.

[2] GOLDSMITH, N. R.: Dermatitis from Semecarpus anacardium (bhilawanol or the marking nut) spread by contaminated mail. J. A. M. A. **123**: 27, September 4, 1943.

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"I was troubled with considerable itching with the legs, and every part of my body which had come in contact with the spar, especially about the abdomen and lower parts, having sat across the tree when barking it. All the parts affected became red and inflamed, breaking out in innumerable pustules, which emitted a yellowish matter with a nauseous smell. The itching was exceedingly painful and irritating, and my arms having been bare when operating upon the tree, also became inflamed and broke out as already described. The neighboring natives, who came to watch my proceedings, now warned me, too late, not to touch the tree, as it was a poisonous one, and advised my keeping quiet and not to touch or scratch the parts inflamed. This advice, however, I could not follow, the irritation for several days being excessive. I employed no remedy, but bathed daily, as usual, in fresh water, although advised to the contrary; and did not get rid of the injurious effects of the itch-wood for nearly two months."

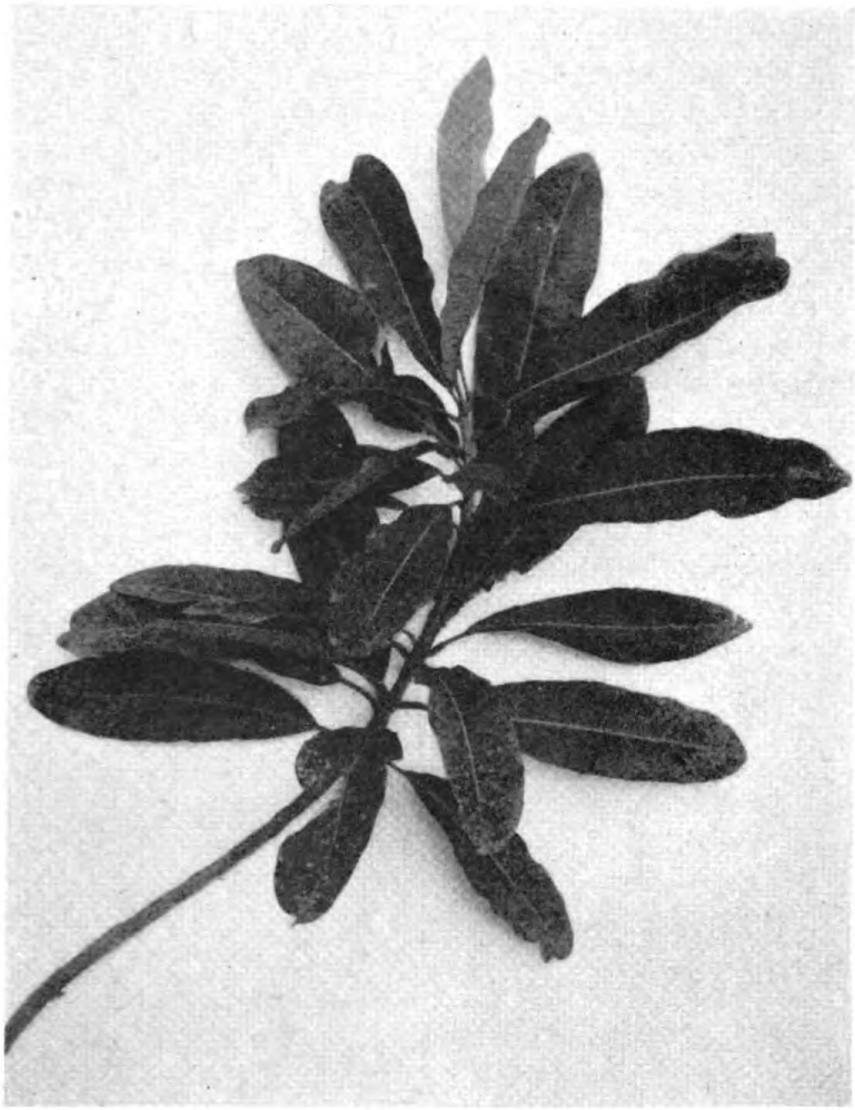


1. The acajou (Semecarpus atra) in typical native habitat. The tree shown is approximately 35 feet high.

The acajou (Semecarpus atra) is a straight tree attaining 30 or more feet in height (figs. 1 and 2). It possesses a sturdy trunk and

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widespreading branches. The leaves are dark green above, glaucous below, and obovate, with a corklike petiole. The leaf veins are yellowish and conspicuous. The flowers are white with a central yellow honey disc and sweet scent. The fruit is red and shaped like the cashew nut. Damage to the bark exposes the sticky, milky latex which on exposure quickly becomes black and tarlike. It is this latex, either fresh or dried, which contains the noxious substance.



2. A terminal branch of Semecarpus atra showing shape and arrangement of the leaves. No fruit was available at the time this photograph was made.

The tree is prevalent in the woods and jungles of islands to which it is indigenous. In these localities it offers a ready source of durable lumber and because of this had frequently been used by the uninitiated in camp construction. On the other hand natives of these islands are familiar with the potential dangers of the acajou and will readily warn the stranger to avoid the pitchlike sap found adhering to the

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bark. It is commonly believed among the natives that sleeping under this tree will result in a dermatitis. The theory is that the dew brings down a sufficient quantity of the latex to produce the eruption. It has been impossible to verify this by personal observation.

The majority of cases seen have been in Marine Corps personnel. In one camp approximately 50 percent of a large detail working on a mess hall in which this tree was used for lumber were incapacitated in varying degrees by the dermatitis.

The dermatitis caused by this Anacardiaceae begins as a pruritic, slightly edematous area of erythema which within 24 hours is covered by closely packed, superficial, thin-walled vesicles. At this stage the eruption is indistinguishable from the more familiar rhus dermatitis. However, one phase of the early stages is worthy of note. The latent period between contact with the tree and development of the first signs or symptoms of the eruption may be unexpectedly prolonged; in no instance has the erythema appeared in less than 48 hours. In some artificially exposed cases the original erythema and pruritus did not appear until 5 days after application of the sap. This property of delayed reaction might be of importance to a medical officer in the field in connection with his prognosis of the number of personnel to be incapacitated after an exposure.

In 2 or 3 days the vesicles become flaccid, rupture, and coalesce, and in large measure the skin is denuded of the superficial layers of epithelium. For a few days weeping is profuse as in the case of a severe dermatitis venenata from the more common plant offenders. From this point, however, the progress of the disease varies appreciably from that of the usual rhus dermatitis. In almost all the cases seen here the acute phase was followed by one of extensive eczematization in which a self-propagating, enlarging vesicular and papular scaling dermatitis appeared. This manifestation occurred without further contact with the offending substance and usually persisted for approximately 2 weeks, although in some individuals it extended over a period of a month before gradually subsiding.

The patients observed here were seen chiefly in the summer months (December, January, and February). They volunteered the information that more persons were attacked and with greater severity when the skin was wet with rain or sweat. This has also been observed in other types of dermatitis venenata.

The results of treatment in these cases by the usual local applications of wet dressings, lotions, and (in the eczematous stage) soothing ointments, were neither better nor worse than those encountered in other types of dermatitis venenata of the same degree.

It is interesting to note that for many generations the natives have applied powdered charcoal thickly to the involved areas, allowing it

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to remain in place until the crust spontaneously separates in about 15 days.

In an effort to get a more complete picture of the sequence of events in this dermatitis, 10 volunteers were subjected to the offending agent. A very small amount of the fresh white sap was applied to an area not exceeding one cubic centimeter on the flexor surface of the forearm and allowed to remain uncovered. In one subject the results were negative. In another the first pruritus and erythema appeared after 48 hours. In 7 additional individuals it occurred during the third or fourth day, and in one, not until the fifth. All the artificially induced cases passed through the typical stages as previously described.

As expected in a dermatitis of this sort there was an appreciable variation in the degree of severity of the reaction. There was no apparent correlation between the length of the latent period and the severity or duration of the eruption. Autoinoculation to various parts of the body was observed in several of the volunteers. In two instances self-propagating extension of the later stages of the dermatitis to involve the entire arm, shoulder, and neck on the side tested was seen. The response to treatment in these artificially induced cases paralleled closely the response in those accidentally contracted.

DICUMAROL

Dicumarol given to human beings produces prolongation in the prothrombin time and coagulation time.

The minimal effective dose should be employed. This dose varies with each individual. It appears that the initial dose of 5 mgm. per kgm. with subsequent daily oral doses of from 1 to 1½ mgm. per kgm. is effective in most patients. A single intravenous dose of 4 mgm. per kgm. was found to be suitable and effective. This dose may be repeated when necessary.

During the period of observation, the prothrombin time and the coagulation time should be determined not less often than once daily. If the prothrombin time becomes too great the dicumarol should be withheld temporarily. Blood transfusions of from 300 to 600 cc. are effective in controlling bleeding.

No gross toxic effects other than bleeding in one patient following curettage of the uterus attended the use of dicumarol.

Administration of vitamin K did not prohibit or correct the prothrombin deficiency produced by dicumarol.—MEYER, O. O.; BINGHAM, J. B.; and AXELROD, V. H.: Studies on hemorrhagic agent, 3,3′-methylene-bis (4-hydroxycoumarin); method of administration and dosage. Am. J. M. Sc. 204: 11–21, July 1942.

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WOUND INFECTION IN HOSPITAL

Eighty-six percent of all wounds and 67 percent of burns became infected during treatment. The organisms were mostly of low pathogenicity, though in the 708 cases studied, 146 became infected with hemolytic streptococci and 231 with *Staphylococcus pyogenes*. Hemolytic streptococci accounted for most of the severe complications, and in many of these blood culture was positive. On the whole, however, the staphylococci and Gram-negative bacilli, especially *Proteus* and *B. pyocyaneus*, were apparently responsible for the greatest retardation of healing.—DE WAAL, H. L.: Wound infection; preliminary note on combined clinical and bacteriological investigation of 708 wounds. Edinburgh M. J. 50: 583, October 1943.

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BLOOD PRESSURE AND OPERATIVE PROCEDURES

Exploration of the abdomen and palpation of the common bile duct are nearly always followed by a fall in blood pressure, and in some cases with weakening and temporary irregularity of the pulse. With a well-planned local and regional infiltration this is largely eliminated. Pulling on the mesenteries or parietal peritoneum to close the abdomen causes a similar fall, as also does packing the intestines into the abdomen. Manipulation of the renal pedicle affects the pressure adversely, while in a radical breast operation the pressure is continuously low, with limited response to the usual dose of pressor drug.—DODD, H.: Significance of blood-pressure readings in general surgical work; with special reference to cardiac index. Brit. M. J. 2: 811–813, December 25, 1943.

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OBSERVATION OF SKIN DISEASES IN THE TROPICS

JAMES R. DELANEY
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Skin lesions are common clinical manifestations among the personnel engaged in battle operations in the South Pacific. The following observations are drawn from the statistics of this hospital and out-patient department, as well as its two advance posts in the combat area.

Patients with dermatologic disorders are sent to the base hospital for admission only when the disorders are severe and disabling, or of long standing without response to treatment although the patients are ambulatory. Most of these are treated in the sickbays, first-aid stations and out-patient departments. When one realizes the time consumed by each patient coming to sick call, the waiting, the 30-minute soaks, the no duty time, it is easy to see the enormous number of man-hours lost.

There is a certain unwarranted stigma to skin infections. Men often feel that it is an indication of poor personal hygiene and some will confide in a friend who has had the same experience. They will often secure some "cure-all" solution or ointment and treat themselves until their lesions are severely irritated, then belatedly appear at sick call.

Fungus infections.—The most common lesion was fungus infection. At least 80 percent of all personnel who have been through this hospital and its out-patient department have, or have had, fungus infection, if they served a minimum of 3 months in this area. These lesions varied from mild dermatophytosis to dermatophytids with superimposed, secondary infections.

Miliaria.—The second largest number seen were those with miliaria (prickly heat). These also varied greatly from early mild localized lesions to those with involvement of almost the entire skin surface.

Ulcers of the skin.—The next largest group was those with ulcers of the skin. These usually were of the lower extremities, and invariably there was a history of a contusion, abrasion, or an insect bite that was irritated and infected, usually by scratching. The next group was those of the impetiginous type and staphylococcus infections. Then follows the contact dermatitis or urticarial group. There were numerous other lesions seen, but they were of no significance in relation

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to the tropics, except leukoderma, of which there were three cases seen in the out-patient department.

Soap irritations.—Early in the establishment of shore activities a considerable number of men reported at sickbay with irritations from soap. Bathing facilities did not exist and fresh water was at a premium. Unless the activity was near a river or the beach, bathing was done with small amounts of water, the soap was not removed, and the irritations followed.

This hot, humid climate where molds and fungi grow freely is a drastic environmental change for soft white skin, previously and continuously clothed for warmth. The skin is constantly bathed with perspiration and the air temperature is consistently high, giving an excellent medium for fungi or bacteria, which at the first opportunity, penetrate the corium and a lesion is started.

TREATMENT

No set routine of treatment was followed in the fungus infections, because of the wide variations of lesions and locations. The medications employed, in general, were saturated boric acid solution, equal parts with potassium permanganate solution (1:3,000 up to 1:5,000) in compress; Whitfield's ointment, one-fourth and one-half strength; and 5-percent salicylic acid in merthiolate or alcohol.

The fungus infections about the abdomen, perineum and inner aspects of the thighs responded well to 24-percent sulfur in aquaphor.

The only treatment of any value for miliaria was direct daily exposure to the sun or ultraviolet rays in suberythemic doses, with the skin kept as dry as possible.

The ulcers of the skin were treated most successfully by keeping the patient in bed, cleansing the lesion with alcohol, followed by azochloramid compresses. Following the boric acid compress, allantoin ointment was placed in the ulcer and a firm compression bandage applied.

The skin infections occurring at this base for the most part are of a minor nature, only 180 (1.55 percent) being admitted to the wards for treatment. It is variously estimated, however, that from 80 percent to 95 percent of the personnel in these areas have skin conditions of a minor nature, and although not hospitalized, frequent the out-patient department.

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DERMATOLOGIC THERAPY IN THE TROPICS

THEODORE M. COHEN
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Diseases of the skin are a major cause of disability among military personnel stationed in the tropics. The chief reason for poor results encountered in dermatologic therapy in this area appears to be intolerance to drugs which in temperate climates are employed with impunity.

In a 3-month period 1,300 cases were seen in the out-patient clinic, the wards, and the dermatology service of this hospital. The out-patient consultation service, established for the various outlying military units, afforded opportunity for the observation and study of cases from 19 different organizations, as well as comparison of the different types of therapy employed in these organizations. An analysis of these cases is presented in table 1.

TABLE 1.—*Analysis of cases of skin disease*

	No. of cases
FUNGUS INFECTIONS, 36.6 PERCENT:	
Epidermophytosis pedis	129
Tinea cruris	71
Eczematoid ringworm of the hands	51
Tinea pedis with "ids"	27
Tinea circinate	22
Tinea versicolor	18
Paronychia	17
Moniliasis	12
Tinea pedis with pyoderma	12
Sycosis barbae	5
Tinea corporis	3
DERMATITIS VENENATA, 9.9 PERCENT, CAUSED BY:	
Mercury	26
Plant	25
Phenol	14
Alkali	9
Adhesive tape	5
Sulfathiazole	5
Sulfur	2
Cresol	2
Carbon paper	1
PYODERMAS, 9.9 PERCENT:	
Impetigo contagiosa	31
Chronic ulcer (pyogenic)	24
Folliculitis	21
Furunculosis	5
Lymphangitis	4
Dermatitis repens	3
Hidradenitis axillaris	3
Bockhart's impetigo	1
Ecthyma	1
Pyogenic granuloma	1

	No. of cases
MISCELLANEOUS DERMATOLOGIC ENTITIES, 43.6 PERCENT:	
Acne vulgaris	70
Verruca	56
vulgaris	46
plana	3
plantaris	3
venereal	4
Eczema	26
Seborrheic dermatitis	25
Miliaria (prickly heat)	18
Insect bites	17
Pediculosis pubis	16
Dermatitis medicamentosa	16
Pityriasis rosea	11
Neurodermatitis	8
Psoriasis	8
Scabies	7
Lichen planus	6
trunk	1
oral mucosa	2
penile	3
Vitiligo	5
Herpes zoster	5
Chronic urticaria	5
Exfoliative dermatitis	4
Alopecia	4
Yaws	3
Melanoma	3
Herpes simplex	3
Erythema multiforme	3
Alopecia areata	3

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TABLE 1.—*Analysis of cases of skin disease*—Continued

MISCELLANEOUS DERMATOLOGIC ENTITIES, 4.36 PERCENT—continued.	No. of cases
Neurofibromatosis (von Recklinghausen's)	3
Ariboflavinosis	2
Schamberg's disease	2
Creeping eruption	2
Spider angiomata	2
Elastic fiber atrophy	1

MISCELLANEOUS DERMATOLOGIC ENTITIES, 43.6 PERCENT—continued.	No. of cases
Black hairy tongue	1
Onychogryposis	1
Bilateral symmetrical lividity of the soles	1
Erysipeloid	1
Leprosy	1

The figures in table 1 were obtained from cases seen in consultation and do not represent the regular run of cases seen at sick call in the dispensaries. The patients, whose dermatologic entities are represented in table 1, were referred to the consultation service because of some complicating factor in either diagnosis or treatment.

The three largest groups, the fungus infections, dermatitis venenata, and the pyodermas, are discussed together. An uncomplicated fungus infection was rarely seen; either a secondary infection or a dermatitis venenata was usually superimposed. Epidermophytids were present in 29 percent of the cases of trichophytosis pedis. Dermatitis venenata usually resulted from intolerance to certain drugs, or to excessive concentrations of these drugs. The use of these agents on an already debilitated skin often produced severe secondary reactions with vesiculations, edema, weeping and severe pruritus.

Many orthodox dermatologic drugs, formulae, and treatment methods which are harmless and effective in temperate climates proved to be irritating in the tropics. Phenol, mercury, and sulfur, as employed in ointments, pastes, lotions, aqueous and alcoholic solutions, even though dilute, produced an irritant dermatitis in many patients. The high humidity with a resultant dampness of the skin and increased hyperhidrosis, and a tendency toward dependent edema, appears to lower the natural resistance of the skin, making it more vulnerable to pyogenic invasion as well as intolerant to accepted therapy.

The superimposed pyodermas usually occurred as a result of poor personal hygiene or poor facilities for proper cleansing of the affected parts. Twenty-four percent of the pyodermas were the tropical ulcers seen at all of the hospitals in the South Pacific area.

These ulcers usually begin as a traumatic lesion on the leg, such as a coral cut or an excoriated insect bite. Within 24 to 36 hours a surrounding area of erythema and induration appears, and within another 48 hours the center of the lesion sloughs, leaving an ulcer with a mild seropurulent exudate on its base. The lesion is slightly tender and does not cause a great deal of discomfort except that it necessitates daily visits to the sickbay for treatment and dressing. Some of these ulcers had existed for as long as from 3 weeks to 9 months before the patients were admitted to the hospital. The patients usually stated that "everything" had been tried with no improvement. The preparations used almost always included drugs

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and formulae which we have found to be primary irritants on debilitated skin.

TREATMENT

1. The patient is hospitalized and ordered to remain in bed with his leg elevated.

2. Three times daily, warm compresses of potassium permanganate in 1:15,000 solution are applied to the ulcers for 20 minutes, following complete removal of detritus and crusts.

3. An ointment composed of the following is applied on a light dressing:

	Gm. or cc.
Sulfathiazole	5
Triethanolamine	10
[1] Water in oil emulsion base q. s. ad	100

[1] The water in oil emulsion base referred to in this article is prepared as follows:

Sodium lauryl sulfate	20 gm.	White petrolatum	200 gm.
Hexadecyl alcohol	90 gm.	Liquid petrolatum	300 gm.
Octadecyl alcohol (Lanette wax)	90 gm.	Distilled water	700 cc.

In all cases complete healing was obtained in from 8 to 20 days. A second series of cases in which USP boric acid ointment was used in place of the 5-percent sulfathiazole ointment gave comparable results. This simple routine proved effective where many new and complicated formulae failed.

In the management of large groups of dermatophytoses, our best results were obtained by basing treatment of the condition on the severity of the dermatitis, and not on the specificity of the offending invader. In acute cases characterized by weeping and vesiculation, cases in which maceration may or may not have been present, continuous wet dressings were employed. The solutions used in order of their frequency were Burow's 1:30; saturated boric acid; and potassium permanganate 1:15,000.

As the inflammation subsides, boric acid ointment is applied to the areas involved in the intervals between wet dressings. As the lesions "quiet down" and exfoliation begins, a mild ointment is applied at bedtime. This ointment consists of:

	Gm. or cc.
Salicylic acid	1
Benzoic acid	2
Ichthyol	1
Water in oil emulsion base q. s. ad	100

In the morning it is wiped off and a 10-percent borated talcum powder applied. Several fungicidal powders proved to be irritating and their use has been discouraged. When it is desirable to use a topical application in preference to an ointment, a 2-percent aqueous solution of

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gentian violet has been used. Ten-percent salicylic acid in tincture of merthiolate which was widely used proved to be the most common cause of a dermatitis venenata due to a topical irritant. The use of this preparation for the treatment of fungus infections has been discontinued. Ointments can be effective if used on nonambulatory patients and for only a limited time, usually overnight.

In the pyodermas the following routine had been generally employed: (1) Soaking the affected parts in potassium permanganate 1:15,000 solution for 20 minutes, 3 times daily; (2) complete debridement of crusts and pustules; (3) application of a 5-percent sulfathiazole ointment to the affected parts.

In impetigo contagiosa the success of the treatment depends on the completeness with which all crusts and debris are removed from the lesions. Contrary to general belief, daily shaving is necessary in the management of impetigo contagiosa if a rapid cure is desired. A 5-percent sulfathiazole ointment applied 3 times daily after removal of all crusts usually effects a cure. Occasionally it has been necessary to use a 5-percent sulfadiazine ointment when a streptococcus was the offending organism. These routines have usually been adequate for the treatment of the common pyodermas.

The problem of dermatitis venenata in the tropics is second only to the fungus diseases. Several plants are the direct cause of an acute vesicular dermatitis similar to that caused by poison oak and poison ivy in the United States. Thirty percent of all cases of contact dermatitis were due to those plant irritants. The treatment routine employed is as follows:

1. Continuous ice cold wet dressings of Burow's solution 1:30.
2. As the edema and vesiculation subsides calamine lotion (without phenol) is applied in the intervals between wet dressings.
3. When the exfoliative stage is reached a soothing ointment is applied twice daily which consists of:

	Gm. or cc.
Menthol	1
Camphor	1
Boric acid	5
Oil and water emulsion base q. s. ad	100

There is no short-cut to the treatment of any acute dermatitis venenata, except that roentgen ray therapy, if available, when given in doses of 75 units for 1 to 3 exposures, may reduce the treatment time. Attempts to rush the treatment in other ways usually result in a flare-up of the condition with a consequent loss in time.

Seborrheic dermatitis occurs in a high percentage of the personnel in this area. The increase in sebaceous-gland activity due to the climate, in addition to the lack of adequate washing facilities, predispose to this condition. The following preparation is rubbed into

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the scalp or other areas involved, twice weekly, and is washed out with bland soap after 24 hours:

	Gm. or cc.
Salicylic acid	3
Sulfur, precipitated	5
Duponol	1
Water in oil emulsion base q. s. ad	100

Miliaria (prickly heat) is a cause of discomfort. The following preparation has proved effective when applied to the affected parts twice daily:

	Gm. or cc.		Gm. or cc.
Resorcinol	2	Glycerin	10
Sulfur, precipitated	5	Alcohol (95%)	35
Zinc oxide	20	Water	35
Starch	20		

The use of a small paint brush facilitates the application of lotions.

CONCLUSIONS

The importance of simple bland therapy in all skin diseases encountered in the tropics is emphasized, and it is shown that many drugs that are used with complete impunity in the United States are not tolerated in tropical climates. A good rule to follow is: The more acute the dermatitis, the milder should be the therapy.

1. The use of phenol, mercury, sulfur, and keratolytic agents should be restricted in the tropics.
2. Most acute dermatitides, regardless of the etiology, should be treated with wet dressings until the inflammation has subsided, before mild specific therapeutic measures are instituted.
3. Crusts and dead skin should be completely removed before any ointment or other topical application is employed.
4. All dermatologic therapy should be mild, for overtreatment is a frequent cause of chronic dermatitis.



LANDMARKS IN ANO-RECTAL EXAMINATION

Certain landmarks in the anal and ano-rectal musculature can always be palpated and recognized. These landmarks are as follows: (1) The subcutaneous part of the external sphincter ani, which lies just beneath the skin at the anal opening and can be felt throughout its circumference; (2) the anal intermuscular septum; (3) the lower border of the internal sphincter ani, felt and recognized just above the groove of the anal intermuscular septum in the lower part of the anal canal; (4) the ano-rectal ring; (5) the puborectalis portion of the levatores ani.—DANIELS, E. A.: Ano-rectal suppurative disease and ano-rectal fistula. Canad. M. A. J. **50: 147–154, February 1944.**

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HYPERTENSION

Hypertension is a very common disease; as a cause of death it is four times as great as cancer. Two types of essential hypertension, the benign and the malignant, run distinctly different courses. It has been quite definitely shown, by the work since Goldblatt's renal clamp experiments, to be of renal origin. The management consists largely of common sense treatment designed to relax the nervous system, to save the heart from extra stress and strain, and to protect the kidneys as much as possible from further damage. There are a certain number of cases due to unilateral kidney disease in which we may expect good results by surgical treatment. We must be especially alert for these cases amenable to surgical treatment in children and young adults.—SEDLAK, O. A.: Advances in treatment of hypertension. Journal-Lancet 64: 22–24, January 1944.

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PITRESSIN EFFECT ON MYOCARDIUM

Histologic changes were observed in the myocardium after the repeated injection of large doses of pitressin. The myocardial lesions resembled those which occurred after the administration of toxic doses of digitalis. They were focal in distribution and were most prominent in the subendocardial layer of the left ventricular musculature.

Cellular degeneration was also observed in the cerebral cortex and gastric lesions were observed after the injection of large doses of pitressin.—DEARING, W. H.; BARNES, A. R.; and ESSEX, H. E.: Experiments with calculated therapeutic and toxic doses of digitalis: V. Comparative effects of toxic doses of digitalis and of pitressin on electrocardiogram, heart, and brain. Am. Heart J. 27: 96–107, January 1944.

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VALUE OF SULFONATED OILS IN THE TREATMENT OF BURNS AND OTHER DENUDED SURFACES

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The need of a preparation for the cleansing and treatment of extensively burned or denuded areas has long been recognized. In many cases, whether the injuries are the result of military action, or a civilian catastrophe, the burned areas are contaminated with grime, oil and grease, the patient in severe shock, thus preventing early cleansing or debridement of the involved areas.

Many types of coatings for such injuries have been used, such as films containing wax-paraffin mixtures, dyes, and more recently films of cellulose compounds. In some instances sulfa drugs have been used. In every case the film is intended to (1) coat the surface to exclude air; (2) retain body fluids; (3) promote healing of the injured surfaces; (4) prevent infection. In most cases the films formed are not very pliable, resulting in cracking, and may or may not be soluble in water.

In the cases where initial shock is slight, and when facilities for primary debridement are available, sulfonated oils are extremely effective in rapidly cleansing involved areas with negligible additional trauma. The rapid and complete emulsification of grease, oil, and dirt by sulfonated mineral oil, in addition to its nonirritating properties, make it preferable to soaps and solvents of the hydrocarbon group. Areas so prepared are suitable for initial therapy, in which immobilization and compression bandage technic are employed or, if desired, a spray film preparation.

When a large group of cases or a patient in severe shock is encountered, a spray film preparation replacing primary cleansing, would seem indicated.

Because of these facts, experiments were undertaken to produce a spray film coating exhibiting the following requirements:

1. Noninjurious to already injured tissue.

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2. Soluble in water at body temperature.

3. Susceptible of spraying at such a temperature as not to injure denuded or burned tissue.

4. Dryness and pliability at body temperature without running or exhibiting tackiness.

5. Containing a chemotherapeutic drug in a readily absorbable state.

6. Homogeneity; ease of spraying through a pressure-type spray gun.

7. Easily applicable in the field, so that large numbers of casualties could be sprayed without delay.

8. When washed off will take with it emulsified grease, oil, and dirt, leaving the affected areas ready for definitive treatment.

Emulsifying and detergent agents have been used in textile, leather, and other defense industries for the purpose of cleaning and degreasing. An investigation, with the possibility of using these agents for cleansing tissue areas, showed the following:

1. Sulfonated oils, particularly sulfonated mineral oil, could be used for the removal of oil, dirt, or grease from injured surfaces.

2. Such surfaces could be easily cleaned by coating with the oil and then washing the area with a spray of water at body temperature.

3. The oil was stable under conditions likely to be encountered, and would not further injure the tissue upon which it had been used.

4. Duponol C or Orvus could be used as adjuncts to the solvent action of the oil.

EXPERIMENTAL FORMULA

The following formula fulfilled all the requirements except that on solidification the mixture separated into two distinct layers. This, however, is not considered serious, because on reheating and subsequent melting of solidified batches the mixture again became homogeneous. If the material is to be packaged, homogeneity may be assured by stirring the material thoroughly as hardening progresses, and pouring into a container just before hardening.

	Gm. or cc.
Paraffin wax	265
White beeswax	215
Sulfonated mineral oil	330
Sodium-lauryl sulfate	10
Water	30
Sulfonamide	50
Triethanolamine	100
	1,000

The addition of oleic acid in stoichiometric proportions, based on triethanolamine, gives a homogeneous product; however, this product when sprayed produced a film that was dry and cracked easily. The threshold of the oleic acid addition was found to be 8 percent

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of the total weight above. At this concentration, the film characteristics were not conducive to the incorporation of the oleic acid in the formula.

Attempts to increase the pliability of the formula by the addition of resin were not successful, the film showing the same characteristics as with oleic acid. Further experiments incorporating methyl and ethyl cellulose were also unsuccessful owing to the insolubility of these products. Experiments in which beeswax was used proved it to be unsuitable because of the high temperature required for spraying. Paraffin alone, although giving a low temperature spray, formed a nonpliable, hard, brittle coating.

The product melts at approximately 103° F. and has a pH of approximately 8.6. In spraying, variation in film characteristics may be obtained by varying the distance between the surface to be coated and the tip of the spray gun. Coats varying from a slightly porous texture to a continuous film may be readily obtained. It is believed, however, that a thin porous coat is more advantageous in that it is more easily removed with water. The film, whether in a porous or continuous state, shows marked tenacity in sticking either to wet or dry surfaces. In the formula the paraffin-beeswax ratio has been determined to give the required film when combined with the sulfonated oil.

Other materials available did not give the coating desired. Experiments are being continued to determine whether or not a homogeneous product might be evolved. It is thought that the higher alcohols, particularly cetyl and stearyl, might be applicable. The incorporation of sodium-lauryl sulfate improves the emulsifying properties of the film and reduces surface tension, thereby facilitating the absorption of the chemotherapeutic drug. In addition the sodium-lauryl sulfate has a slight bacteriostatic action of its own.

The small amount of water added serves to dissolve the sodium-lauryl sulfate, secure film pliability, and at the same time pre-emulsifies the over-all product. This incorporation of water with the resultant pre-emulsification makes the subsequent film removal easier.

Triethanolamine, which serves as a vehicle for the solution of the sulfonamide, is in itself an excellent emulsifier. It should be noted here that the sulfonamide is in a readily available state when incorporated in the total mixture.

PREPARATION

In all cases the heating should be done on the water bath. This is necessary to prevent charring and decomposition of the oil. It has also been noted that sodium-lauryl sulfate, when heated with water directly over a free flame or hot plate tends to decompose. By heating over the steam bath the solution is readily effected without decomposition.

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1. First melt the paraffin and beeswax on the bath.
2. Add the sulfonated mineral oil and stir.
3. Combine the triethanolamine and sulfonamide; add the sodium-lauryl sulfate in water. Heat this mixture over the water bath until the solution is clear. (There may be a change of color on heating; however, this has not been shown to be deleterious.)
4. Add the above to the hot paraffin-wax oil mixture, and stir thoroughly.
5. Allow the material to cool slowly, stirring well until sirupy before pouring into containers for storing, or directly into the spray gun for immediate use.

If a solid batch of the material is to be used, it is placed in the body of the gun in a solid condition and heated over the water bath. The heating should be continued until the body of the gun has been in the boiling water bath for 10 minutes.

OBSERVATIONS

1. Freshly denuded areas can be easily coated and cleansed by the formula.
2. Denuded areas treated showed a marked reduction of infection within 48 hours from the beginning of treatment.
3. Surfaces continuously treated showed a marked increase of fresh granulations and epithelization.
4. No irritation of tissue was noted.

SUMMARY

1. Sulfonated mineral oil containing sodium-lauryl sulfate and triethanolamine may be used for the cleansing of denuded tissue without irritation.
2. The formula is easy to apply and forms a dry pliable film over the surfaces involved, whether wet or dry.
3. Grease and dirt are rapidly removed after coating and subsequent washing.
4. The chemotherapeutic agent is in solution, is available for absorption, and has been demonstrated in the blood stream.
5. The formula is beneficial in healing of granulating surfaces.
6. The film can be easily applied under field conditions without complicated equipment.
7. The formula lends itself to the treatment of large numbers of casualties. Emergency field treatment can be instituted and the patient left until individual attention and a more definitive treatment is indicated.
8. During this interval the chemotherapeutic agent in solution acts to help prevent infection.

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BURNS AND THEIR TREATMENT

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Patients treated for burns in this hospital originated from two main sources: Those from this base area, admitted from a few minutes to a few hours after having been burned, and those transported by plane or ship from combat areas and received from 24 hours to 5 days after injury.

Table 1 gives a summary and statistical distribution of patients treated primarily for burns.

The total of 195 cases reported in table 1 does not represent all burns received, because the combat injuries were frequently complicated with burns. When injury was the greater lesion, or the burn area was less than 12 percent of the body surface, the case was classified under the more serious of the two. One pertinent fact relative to most serious casualties received from naval engagements is the high incidence of burns. These injuries are received from bursting bombs and shells and the large number of fires started on board ship by shell fire. There were many cases of burns of minor or secondary nature complicating gunshot wounds and compound fractures which were not included. These burns were usually less than 10 percent of the body surface and were not the primary cause of hospitalization. All burns considered in this report, however, extended over an area exceeding an estimated 12 percent of the body surface.

TABLE 1.—*Statistical distribution of burn patients*

Combat injuries			Noncombat injuries		
Base	Ship	Land combat	Base	Ship	Combat areas
1	101	31	48	0	14

TREATMENT

The patients from combat areas all had received some previous treatment for their injuries, consisting of general measures, usually ½ grain of morphine for relief of pain, 1 to 8 units of plasma as a combatant for shock and loss of serum protein, and local measures

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consisting of almost every known application available. The most common preparation used was some form of tannic acid jelly or gentian violet, and various other ointments.

Generally speaking, most of the wounded received from combat areas had received excellent supportive treatment in the liberal use of blood plasma. Wounds that had had some escharotic preparations used locally were most often infected.

General supportive treatment.—As an aid to evaluation of the condition of patients on arrival from combat areas and to assist in clinical judgment, a complete blood count and urinalysis were done. There were no laboratory facilities for taking hematocrit readings. It was soon learned that though a red blood cell count and hemoglobin determination were of help in evaluating blood protein loss, a normal red blood cell count in a patient having an anemia may represent a marked hemoconcentration. Ordinarily at least 250 cc. of human blood plasma were given as an initial dose for each 10 percent of area of the body surface burned. Subsequent supplemental plasma was used as indicated.

Fluid balance was maintained in order to keep the urinary specific gravity less than 1.020. The diet consisted of whatever was obtainable and desired. No parenteral vitamins were available, but fruit juices were given abundantly and from 3 to 6 poly-vitamin capsules were administered daily.

Active use of the injured parts was encouraged at all times. In severely burned hands and legs, it was found that use of the joints not only prevented contractions but action could be maintained without pain to the patient.

Local treatment.—The method of local treatment used in most of our cases is a paraffin-wax spray over the burned areas after dusting with either sulfanilamide or sulfathiazole powder. Sulfanilamide was used the first 2 or 3 days and sulfathiazole thereafter. In some of the most severe cases, sulfathiazole was given by mouth in doses of 1 gm. every 4 hours for the first 5 to 7 days.

The formula of the wax spray is as follows:

	Gm. or cc.		*Gm. or cc.*
Paraffin	800	Menthol	1
Petrolatum, liquid	250	Camphor	1
Petrolatum, white	150	Oil of eucalyptus	1
Cottonseed or olive oil	50		

Most of the patients with burns admitted from local areas had been given ½ grain of morphine, some local application, and dressings before arrival. In these cases, the dressings were removed and the sulfa powder and wax spray applied directly onto the freshly uncovered wound. Recently acquired burns which had not been previously treated were sprayed similarly except when there was gross contamination. These areas were washed with cotton sponge, white soap, and

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normal saline solution. Loose skin was removed, but blebs were not opened unless they were painful or unusually large.

The wards were open to dust. Freshly laundered sheets were used, and a cradle above the patient was covered with a sheet or blanket. As the wax and debris accumulated over the burned areas, it was washed off with ordinary tap water, or if the patient was able to sit or walk, he was taken to an open shower. Soap and water were used liberally, followed by reapplication of the sulfa powder and wax.

During the first 3 or 4 days frequent spraying was necessary because of the weeping surfaces. Second-degree burns usually dry by the 5th day and need to be sprayed only occasionally. When there is considerable slough in the 3rd-degree burn areas, the slough and excretions incorporate well into the wax spray and are readily removed by simple washing. Several cultures were made of this collection of debris and no pathogenic organisms other than Staphylococcus albus and Bacillus proteus were found, but saprophytes were abundant. The only burns so treated which were seen to be surrounded by any area of inflammation were a few cases of 3rd-degree burns covered by a thick adherent tannic acid eschar. Continuous moist boric acid dressings were used on these to soften the eschar and localize the infection.

COMPLICATIONS

Infection as a complication of burns was not an important factor. No blood cultures were taken at any time. The absence of any inflammatory reaction or septic-type temperature, except in patients having fixed eschars over the wounds, justifies the methods of treatment. The temperatures returned to normal limits by the 5th day in nearly all cases and remained normal.

In the most severe cases, those with more than 25 percent of the body surface burned, mental confusion was common, the patients frequently going into mental as well as physical shock. They may remain irrational for several days. There was frequently early hysterical reaction, later developing into irrationality, and followed by complete amnesia for the entire period. One patient with a 70-percent body surface burn, was irrational for 9 days, then gradually recovered. Burns of the conjunctiva and cornea were common in flash or gas explosion burns.

Gastric crises were present in three cases. One patient had severe epigastric pain for 5 days after the injury. He was unable to take anything but sips of water by mouth during this time and needed frequent administration of opiates for relief. There was no evidence of gastric or intestinal hemorrhage in our cases. Distention from a paralytic ileus, with marked abdominal tenderness and rigidity, developed

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in three patients and appeared as a terminal sign in two. In the third patient it was present from the 7th to the 11th day. He had deep 2nd-degree and 3rd-degree burns over 40 percent of the body area, but eventually went on to recovery. This was probably on a toxic basis, as no evidence of peritonitis was found at autopsy in the two patients that died.

Albuminuria was not so common as frequently reported. It appeared early in the fatal cases, usually going on to complete urinary suppression.

Anemia is commonplace in extensive burns and should be anticipated inasmuch as it develops rapidly. Blood transfusion is the only prevention for this.

FATALITIES

There were 6 deaths attributed directly or indirectly to burns. Three of these patients had had 80 percent or more of the body surface burned; despite this one lived 9 days.

One patient with only about 15 percent of his body surface burned developed convulsions 18 hours after his injury and lapsed into coma from which he never aroused. He died on the 3rd day after injury. This patient had been given 1 grain of morphine, half of which was given intravenously, within 1 hour after the injury. He did not regain consciousness completely at any time. One patient came in by plane from a combat area on the 4th day after injury. His condition was considered critical on arrival; about 40 percent of his body surface had 2nd-degree and 3rd-degree burns. These were covered with a thick tannic acid eschar beneath which there was gross infection. Death ensued.

COMMENT

Many of the noncombat burns resulted from negligence, such as from a man's dumping gasoline on a smouldering fire or filling a gas tank on a field cook stove in proximity to an open flame. The seriousness of such carelessness should be considered gravely in every field camp of the armed forces, and preventive measures instituted. At this base it is now an offense punishable by court-martial to use such hazardous methods of starting fires.

The wax-sulfa powder method of treatment has proved effective. It was used in the majority of our cases. It is simpler to use, not requiring the elaborate surgical setup so often impossible to obtain in war areas. It can be applied rapidly; hence is applicable when a large number are to be handled at one time. It does not require any sterile dressings and thereby relieves the patient of the painful process of dressing changes. Pain is relieved almost immediately, probably simply by occluding air from injured tissues. Morphine was

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seldom necessary after the first day. The burned areas, if on fingers or around joints, may be kept active without pain, and contractions thus prevented. The wax acts as an absorbent for discharge from the slough of deeply burned areas, and is easily removed by washing the burned area with a spray or shower.

Although none of the patients was retained long enough to follow through the reconstructive phase, the wounds were healing satisfactorily and the patient was considered out of danger before evacuation to other facilities.

An essential element in the treatment of burns by any method is a specially-trained group of corpsmen who know how to carry out the simple procedures and who are alert to the rapidly developing clinical signs that may need attention. This group of corpsmen was retained in the burn service.

SUMMARY

1. One hundred ninety-five cases of severe burns were treated between 1 September 1942 and 1 June 1943, with 6 deaths. The mortality rate was 3 percent.

2. Emphasis is placed on early adequate treatment to prevent shock, with the liberal use of morphine and human blood plasma.

3. In the use of sulfa powder-wax treatment of burns it is essential to have a well-trained staff of alert hospital corpsmen to insure proper care.

4. Eschar-producing tannic acid preparations should be discontinued.

5. Burns may be treated satisfactorily under conditions of simple cleanliness; sterile surgical technic is not essential provided adequate supportive treatment is given.

6. Indiscriminate use of gasoline in building fires and in careless handling of gas stoves are major causes of noncombat burns, and measures should be instituted to control them.

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SULFATHIAZOLE IN OIL

The belief, which is widely held, that the suspension of sulfathiazole in oil retards its absorption by the tissues, is erroneous. The rate of absorption of sulfathiazole from the muscles is greatly accelerated when it is injected in saline solution, in oil or in an oil-in-water emulsion. Absorption is more rapid from oil than from saline solution and is more rapid from an oil-in-water emulsion than from oil.

The rate of absorption of sulfathiazole from an oily suspension in the muscles is influenced by the size of its particles. Finely ground sulfathiazole is absorbed more rapidly than the unground crystals.—MAGNER, W., and O'SULLIVAN, M. O.: Sulfonamide treatment of wounds. Canad. M. A. J. 50: 118–123, February 1944.

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ANTITOXIN AND GAS GANGRENE

There were three groups of patients who did not receive the composite treatment recommended, their percent mortality is as indicated: Those who had no surgical treatment and no antitoxin (100 percent); those who had antitoxin but no surgical treatment (92.4 percent); and those who had surgical treatment but no antitoxin (72.8 percent).

It will be seen that the decrease on treatment with antitoxin is due almost entirely to the decrease in the group treated within 6 hours of diagnosis (35.2 percent); those treated between 6 and 24 hours (75 percent); and those after 24 hours (50 percent).—MACFARLANE, M. G.: Therapeutic value of gas-gangrene antitoxin. Brit. M. J. 2: 636, November 20, 1943.

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RESULTS IN LATENT SYPHILIS

Among 5,326 latent syphilitics admitted to the syphilis division of the Johns Hopkins Hospital between 1914 and 1934, there were 926 who were observed for more than 5 years.

The data presented strongly indicate: (a) That latent syphilitics do very well regardless of the type or amount of treatment received, (b) that the optimum amount of treatment to reduce progression to a minimum is approximately 20 injections each of an arsenical and a heavy metal.—DISEKER, T. H.; CLARK, E. G.; and MOORE, J. E.: Long-term results in treatment of latent syphilis. Am. J. Syph., Gonor. & Ven. Dis. 28: 1–26, January 1944.

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RADIOGRAPHY OF THE NECK OF THE CONDYLE

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While fractures occur in the neck of the mandibular condyle less frequently than in some other parts of this bone, it is apparent that these fractures are becoming more common. Table 1 shows that there has been a wide difference of opinion in the literature as to the percentage of mandibular fractures occurring at this site.

Another lack of agreement as to the most frequent location of mandibular fractures exists. Doherty (*1*) (*2*), Ivy and Curtis (*3*), and Dean (*4*) all believe the angle to be the site most often fractured; Logsdon (*5*), Hyde (*6*), and Reiter (*7*) select the mental foramen area; but Parker (*8*) believes that the largest percentage of fractures of the mandible occur at the site of the cuspid tooth. Of more interest is Asbell's (*9*) report that 9 percent of mandibular fractures occur at the condyle. It is his belief that if a fracture occurs at or about the symphysis, one or both condyles will also fracture.

TABLE 1.—*Incidence of fractures of neck of condyle*

Author	Year	Number of cases	Percentage of condyle fractures
Dunning	1915	1,065	0.8
Ivy and Curtis	1926	68	7.3
Schmitziger	1929	135	[1] 18.5
Dean	1930	50	3.2
Woodard	1931	50	[1] 0.15
Winter	1934	126	3.2
Weisengreen and Levin	1936	50	6.7
Asbell	1938	115	9.0
Haynen	1939	669	6.5
Doherty	1940	100	3.0

[1] Asbell's computations from writer's data.

On two points there seems to be agreement. The first is that when these fractures do occur, they are easily overlooked because there is little or no displacement and the parts are difficult to examine clinically. Berger (*16*) aptly describes these difficulties in clinical diagnosis as follows:

> . . . If there is no marked displacement of the fragments, the symptoms, signs, and discomfort may be so slight as to be easily overlooked. . . . Because of the abundance of covering, these parts are not freely accessible to diagnostic manipulation. In the presence of contusion, and especially

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swelling, palpation is of little aid. Such pathognomonic signs as crepitation and false point of motion are not easily elicited. Furthermore when there are one or more fractures in parts more easily observed, attention may be concentrated upon those injuries.

The other point of universal agreement is the belief that careful roentgenographic examination should always be made in cases of suspected fracture and that the neck of the condyle should always be included in the examination.

Ivy and Curtis contend that good x-rays of both sides of the jaw and including both condyles should be made in all cases of fracture of the mandible. Doherty states that the roentgenographic survey should not be limited to two lateral jaw exposures, but should include views of the symphysis, condyle, and coronoid process of the mandible. Brown (*17*) advises that in questionable cases of mandibular fracture, reliance should be placed upon the x-ray examination. Complete views of both sides of the jaw, including both condyles and the symphysis, should be taken because one or more fractures may be missed in clinical examination. Asbell believes that roentgenographic examination should be made in all jaw fracture cases in order to discover additional sites of fracture.

Routine x-ray examination in fracture cases is today considered so important that the courts are rendering decisions (*18*) that indicate they consider it proof of negligence when x-rays have not been made. Even though there is such a concensus as to the need of adequate roentgenographic examination of the condyle in all cases involving trauma at the chin, there is no unanimity of opinion concerning the technic to be used in making the examination.

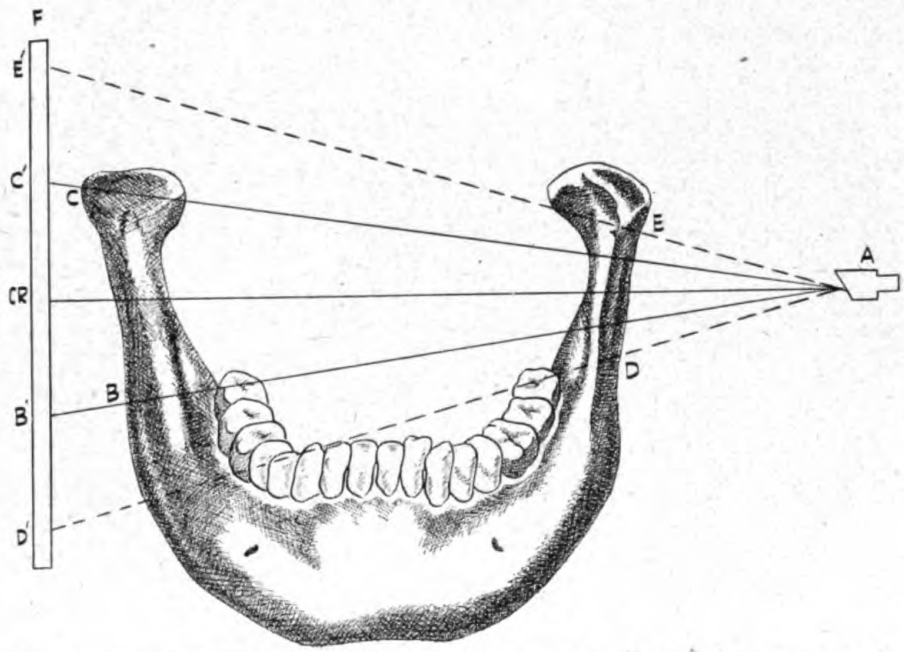
RADIOGRAPHIC TECHNIC

A careful survey of the literature reveals that there are a number of technics that can be used to accomplish the desired results. Apparently however these technics were developed primarily for the purpose of examining the temporomandibular joint and have therefore one or more decided disadvantages. Some technics require expensive and elaborate apparatus to insure proper angulation and head immobilization, while others are so complicated that considerable time is consumed in making the radiographic survey.

Various technics were therefore carefully studied with a view to simplification. A modification of the Schlegel (*19*) technic was evolved. This technic enables an x-ray of the neck of the condyle to be made quickly and easily with very little discomfort to the patient. In doing this the preciseness of the Schlegel technic as related to the examination of the joint itself has been lost. It cannot therefore be expected to produce consistently good x-rays of the tem-

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poromandibular joint. It will however produce adequate x-ray pictures of the neck of the condyle, and it is for this only that it is recommended.



1. Anode at right (A). Film at left F. Condyle being radiographed B–C. Central ray shown at CR.

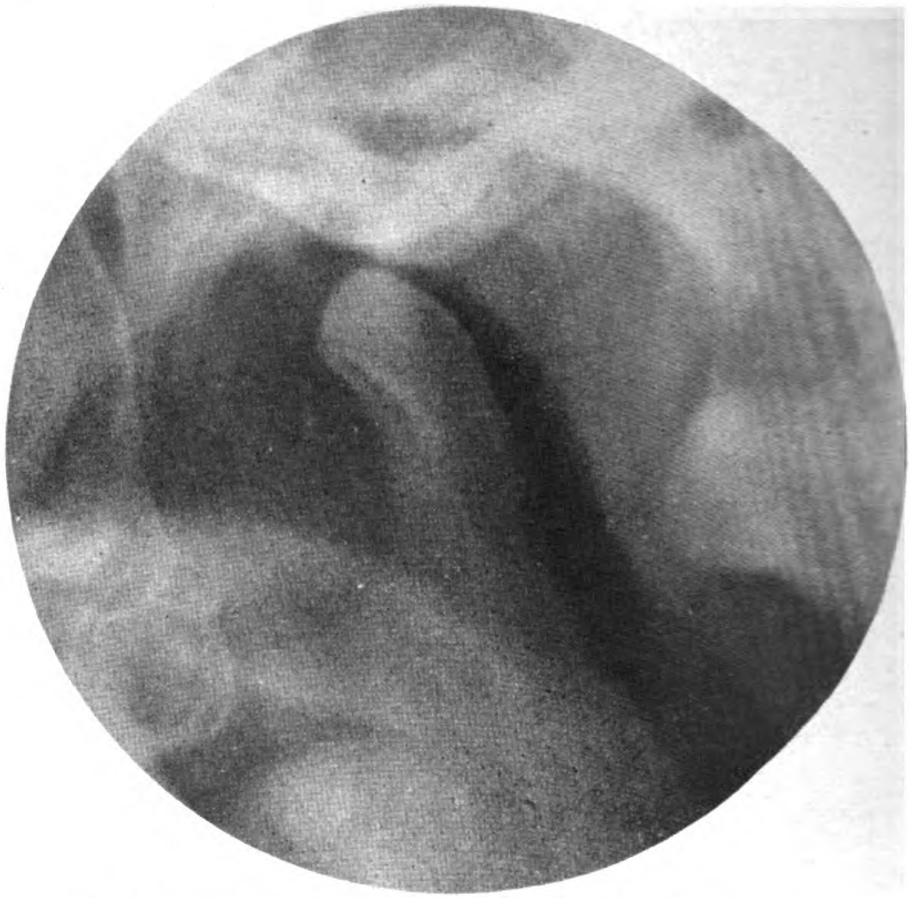
The patient is seated in the dental chair just as though periapical x-rays were to be made of the maxillary teeth. In this position an imaginary line from the ala of the nose to the tragus of the ear will be parallel to the floor, and the interpupillary line of the eyes will be horizontal.

The cassette is held flat against the side of the head in such manner that there is slight chance for movement. It should rest against the cheek and ear so that it will not rock and should be so positioned that the image of the neck of the condyle will be as close as possible to the center of the film. The patient should bite on a large cork so that the mouth can be kept open without movement. This brings the neck of the condyle forward into a position where it can more easily be radiographed.

The dental x-ray apparatus is modified by removing the cone; this makes it possible to decrease the anode film distance by exactly the length of the cone. When this has been done, the apparatus is placed in direct contact with the patient's head over the neck of the condyle opposite the one being examined. The apparatus is so positioned that the central ray will pass directly through the neck of both condyles.

Exposure time.—Screen-sensitive film should always be used with screens. Direct-exposure film should not be used. Since the exposure

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2. Radiogram of the neck of the mandibular condyle.

time will depend entirely upon the speed of the screens and film used, it is not practical to give exact exposure data. One or two test exposures will quickly determine the correct time for the materials of choice and the best result can be used as a basis for later exposures. It may be mentioned however that the correct exposure with "fast" screen-sensitive film and "slow" intensifying screens will be in the neighborhood of 2 seconds.

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PROTEIN DEFICIENCY VS. HYPOPROTEINEMIA

In a discussion of the influence of disease upon the blood protein concentration, the term "protein deficiency" is to be preferred to the more commonly used term "hypoproteinemia." First, by definition, the latter concerns itself only with the circulating proteins which we now recognize as less important than the tissue protein depots. Second, there is a gradual depletion of proteins due to many causes, which although not necessarily sufficient to bring the circulating proteins within the hypoproteinemia range, are none the less important. Finally, a concept of reparation of a protein deficiency in *tissues* as well as blood will best explain our results with treatment.

At present there is no method for the determination of tissue proteins and one must depend upon indirect evidence such as the fate of protein ingested, i. e., that which does not enter the circulation nor is excreted is considered utilized in building up tissue stores. By such evidence it has been found that the ratio of tissue to circulating proteins is 30 to 1. If this is correct, any decrease of plasma proteins implies a depletion of tissue proteins many times greater.—MEYER, K. A., and KOZOLL, D. D.: Protein deficiency in surgical patients. Surg., Gynec. & Obst. 78: 181–190, February 1944.

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GOLD IN ARTHRITIS

If gold is to be effective in arthritis it must be given in a form which is easily absorbed and which will remain in the circulation long enough to reach the site where it will exert its action. Such conditions are probably best obtained by intramuscular injections of the water-soluble gold salts. These drugs are potentially toxic and are retained in the body for a long time after the period of administration. As there is no known method of inhibiting the toxic action, which may appear late in the treatment when the patient has large amounts of gold in his system, it is essential to restrict dosage to the smallest amount known to be effective. When crystalline salts are used the equivalent of 25 mg. gold weekly, which in the case of myocrisin is contained in 50 mg. of the salt, is the minimal effective dose, and the total quantity of gold given should not exceed 1 gramme. Using this amount, the incidence and severity of the toxic reactions fell from 41 to 17 percent, and there were no cases of nephritis, exfoliative dermatitis, or other severe reactions. Smaller doses appeared to be less effective in the treatment of arthritis, and colloidal gold sulphide gave little or no benefit. So far no dosage of gold can be recommended which is both therapeutically effective and yet below the level of toxicity. This makes it all the more important that only cases likely to obtain benefit should be selected for this treatment, and it is difficult to do this, as it is still unknown where, how, or why gold salts work. Major errors can be avoided if it is realized that the only possible action of gold is to lessen or arrest inflammation. No benefit can be expected in osteo-arthritis, which is a degenerative non-inflammatory joint disease, or in old-standing rheumatoid arthritis with irreversible bone and joint changes. Only patients in the active inflammatory stage of rheumatoid arthritis are suitable candidates for the treatment; and even in them improvement is uncertain, and there is always a risk of toxic complications.—Editorial. Treatment of chronic arthritis with gold. Brit. M. J. 329–330, March 4, 1944.

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SULFATHIAZOLE PROPHYLAXIS IN PRE-EXTRACTION TREATMENT OF PERICORONITIS

FRANK M. WENTZ
Lieutenant (DC) U. S. N.

This is a preliminary report on the systemic use of sulfathiazole in 21 cases of pericoronitis. It is not offered as a substitute for conservative treatment but as an aid to more rapid recovery by permitting earlier extraction.

The cases were typical, partly erupted, tissue impacted third lower right and left molars in acute, subacute, and chronic stages of infection. Malposition in the arch and the likelihood of recurrence of infection necessitated extraction.

Good surgical judgment is paramount as in all operations.

The infection was classified into one of three stages and steps were taken accordingly.

CHRONIC INFECTION.

(*a*) *Objective signs.*

1. No trismus.
2. No swelling.
3. Gum flap partially covering tooth or only a cusp exposed in a tissue impaction.
4. Purulent discharge from space between gum and tooth upon applied pressure.

(*b*) *Treatment.*

1. Administer 2 gm. of sulfathiazole immediately and 1 gm. every 4 hours.
2. Perform extraction 8 hours later. In using block anesthesia be absolutely sure there is no infection in the soft tissue through which the needle passes. Extra-oral block should be used if there is any doubt.
3. Deposit a powdered sulfathiazole tablet in the socket and cover with butyn metaphen ointment.
4. Continue sulfathiazole 1 gm. every 4 hours for 2 days.

SUBACUTE INFECTION.

(*a*) *Objective signs.*

1. Trismus moderate in degree.
2. Slight swelling of cheek.
3. Tenderness of submaxillary lymph nodes.
4. Little or no purulent discharge upon pressure on gum flap.
5. Temperature hovers around 99.1 or 99.2° F.

(*b*) *Treatment.*

1. Sulfathiazole 2 gm. immediately and 1 gm. every 4 hours. One glass of water each hour.

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2. Many times the case is complicated with Vincent's organisms and appropriate local measures must be carried out.
3. Hot sodium perborate mouth rinses every 2 hours. Rinse for 10 minutes by the clock.
4. Laxatives.
5. Blood and urine examinations are carried out if necessary. The closest cooperation with the medical department is followed in this therapy. The temperature is usually normal 24 hours after treatment has been instituted. If upon examination the patient's oral symptoms and trismus have improved the tooth should be extracted.
6. Deposit a powdered sulfathiazole tablet in the socket and cover with butyn metaphen ointment.
7. Continue sulfa drug for 2 days.

The patient is usually symptomless after extraction and a rapid return to normal is shown by the tissues.

ACUTE INFECTION.

(*a*) *Objective symptoms.*

1. Extreme trismus.
2. Gross swelling of cheek.
3. Oral examination usually impossible because of trismus.
4. Tender submaxillary lymph nodes.
5. Temperature approaches 101° F.

(*b*) *Treatment.*

1. Same treatment as for subacute type.
2. If the patient does not show signs of improvement within 48 hours increase the sulfa drug to 2 gm. every 4 hours, with strict attention to blood and urine picture.
3. If fluctuant, lance, and drain. Continue the administration of the sulfa drug.
4. Extract tooth in 24 hours if symptoms have subsided.
5. Deposit a powdered sulfathiazole tablet in the socket and cover with butyn metaphen ointment.
6. Continue the administration of the 1-gm. sulfa tablet every 4 hours for 48 hours.

This regimen was formulated for the handling of cases at an outlying base supplied only with portable dental equipment where general anesthesia facilities were unavailable for oral surgery. The patients were either transients going on to combat zones, having to move with their assigned groups, or they were key men whose sick leave had to be reduced to an absolute minimum.

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SOFT TISSUE PROTECTION IN FRACTURE TREATMENT

JAMES W. TOUMEY
Lieutenant Commander (MC) U. S. N. R.

The protection of soft tissue in fracture treatment is axiomatic. The utmost care should be exercised in plaster cast padding, immobilization, placing of the injured limb, and in applying traction.

The treatment given a fracture in the first few hours after trauma frequently influences the entire course and prognosis of the injury. Simple fracture cases have had complications resulting from the initial emergency treatment of a more serious nature and disability than the original fracture. Most complications arise from "overtreatment" rather than "undertreatment." The medical officer treating fractures under adverse conditions and with limited assistance and equipment must be particularly alert to the dangers in the method of treatment employed.

The cardinal proscriptions which should be remembered by those called upon to treat fresh fractures are:

1. *Avoid the use of unpadded plaster casts.*—Unpadded plaster casts should never be used in fresh injuries, or by those not expert in this type of treatment. The danger of soft tissue injury from unpadded casts far outweighs the effectiveness of the immobilization which it affords.

2. *Ankle traction should never be used.*—This is usually applied by a bandage or strap around the ankle, to which a windlass or weights are attached. Although ankle traction is advised in the First-Aid Manual, it is a dangerous procedure and should not be used as it may do harm even in the short interval of one-half hour. It has been observed that most of the disasters from skin pressure have been in the lower extremity, with ankle traction as the outstanding cause. Even when the ankle is well padded with cotton or felt, pressure ulcerations often result.

3. *Do not employ ankle traction applied to a shoe.*—The First-Aid Manual has advised leg traction with the shoe on the foot, and the cord attached to the heel of the shoe. The pull in this case comes over the dorsum of the foot near the ankle, a vulnerable location for a pressure area. This type of traction usually creates little or no pain at the site of pressure and results in a pressure sore. Steady pressure numbs the skin area involved, and deep necrosis, even to bone, can

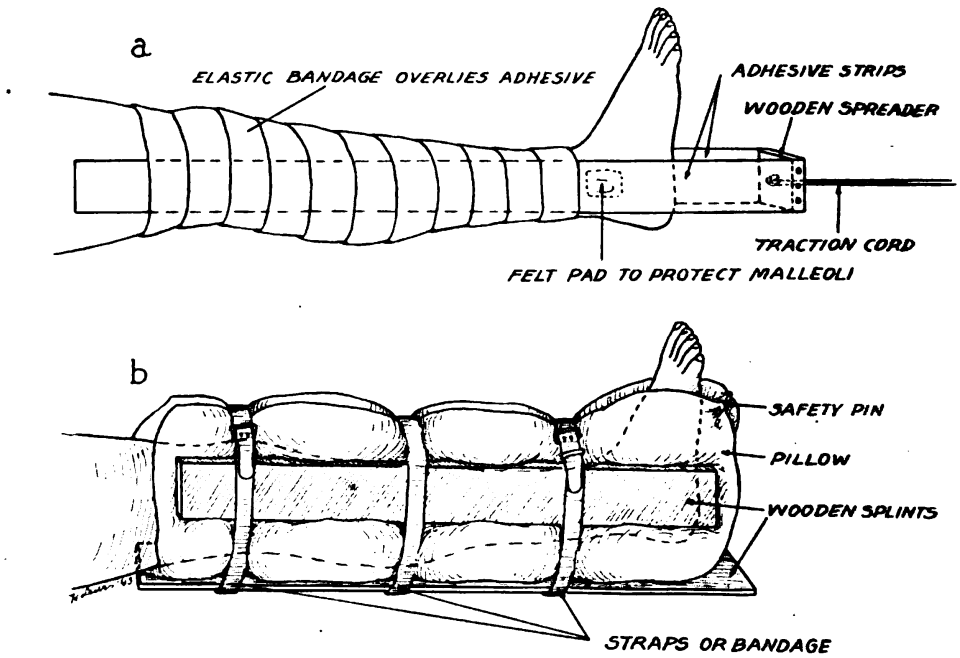
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take place under the cast or traction apparatus. It may cause the extensor tendons to slough. These areas over the ankle are difficult to heal, frequently requiring an isograft before healing.

RECOMMENDATIONS

Several cardinal recommendations which should be remembered by those called upon to treat fresh fractures are:

1. *Always apply padding beneath plaster casts or splints.*—This is important in cases of recent injury. Sheet (cotton) wadding may be used, and the entire part should be well padded. Additional protection should be used over bony prominences, such as felt or several thicknesses of sheet wadding.



1. (*a*) Shows proper application of adhesive traction apparatus. Note extra padding over malleolus. (*b*) Illustration of "pillow and sides" immobilization.

2. *Elevate the extremity.*—Position is important in the control of swelling, and prevention of swelling decreases the danger of tissue injury from pressure.

3. *When traction is necessary, use adhesive strip traction.*—Leg or arm traction is sometimes indicated, as on shipboard, when a base hospital will not be reached for many days. If there is a shaft fracture of a long bone, with overriding and no skeletal traction available, the best form is the use of skin traction with adhesive (fig. 1a). Shaft fractures of the humerus are more simply treated by the hanging cast method. This consists of a circular plaster applied from the upper arm to the wrist, which allows the arms to hang and which is steadied

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by a loop of bandage tied about the neck and attached to the cast at the wrist.

4. *Use a simple immobilization splint rather than a traction splint whenever possible.*—The "pillow and sides" is the best example of the simple immobilization splint, and is the safest and most comfortable for the patient. Transportation in relative comfort without traction and its attendant dangers can usually be accomplished with this type of splint. Emergency traction hardly ever reduces the fracture and a late reduction is preferable to early reduction with pressure trauma. This method may be employed even in femoral shaft fractures (fig. 1b).

SUMMARY

1. Unpadded plaster casts or splints cause unnecessary injury in recent fractures.

2. Ankle traction results in pressure ulceration in many cases.

3. Traction applied to a shoe invites a pressure area with necrosis following.

4. The extremity must be elevated.

5. A simple immobilization splint, rather than a traction splint, is best in emergency treatment.

6. When traction is necessary, adhesive strip traction, rather than hitches or bandages about the ankle or wrist, should be used.





PROTEIN DEFICIENCY IN SURGICAL PATIENTS

Incidence of plasma protein rise was related to the amount of whole blood, plasma, or amino acids, and combinations thereof administered. Consistent improvement was seen when 2,000 cubic centimeters or more of blood alone or in combination with plasma or amino acid was given.

Whole blood appears to improve plasma proteins more than does plasma due to the value of hemoglobin as a protein source.

The combination of amino acids and whole blood as a means of treating hypoproteinemia warrants further use.

The daily observation of the total protein, hematocrit, and hemoglobin is suggested as an aid in deciding whether whole blood, plasma, or dextrose and/or saline solutions meets the patients' requirements best.—MEYER, K. A., and KOZOLL, D. D.: Protein deficiency in surgical patients. Surg., Gynec. & Obst. 78: 181–190, February 1944.

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BIOSYNTHESIS OF VITAMIN B_1

It has always been assumed that man, unlike the rat and some ruminants, is unable to synthesize vitamin B_1, and that he therefore depends entirely on food for his supply of it. In nine adolescent males given a vitamin-free diet after three to five weeks there was clear clinical evidence of vitamin-B_1 deficiency in only five out of nine of the subjects. Examination of the stools, however, showed that the five with signs of deficiency had practically no free vitamin B_1 in their stools, whereas the four who remained symptom-free had large quantities in their stools, in spite of a zero intake. The most likely explanation was that intestinal bacteria were synthesizing vitamin B_1 in the large intestine, from which it was absorbed. To obtain direct evidence of this, succinylsulphathiazole (which is bacteriostatic in the intestine) was given to one of the subjects excreting vitamin B_1 in his faeces. In a week the faecal excretion fell from 37 to 52 micrograms daily down to zero and returned to its former value on discontinuance of the drug. Absorption of vitamin B_1 from the large intestine had still to be proved. This was done by administering retention enemas containing vitamin B_1; a pronounced rise in the urinary excretion of vitamin B_1 was the result.

These observations demonstrate that the biosynthesis of vitamin B_1 can occur in man. It also raises the question whether man requires an exogenous source of vitamin B_1. Since it is likely that the biosynthesis of vitamin B_1 is affected by diet, as is known in the case of animals, the vitamin-B_1 requirement of man must be considered in terms of particular diets rather than in general. One further point is worthy of emphasis. Sulphonamide drugs can apparently inhibit the biosynthesis of vitamin B_1 in man. This may be of clinical significance in the case of patients treated with such drugs who are on diets poor in vitamin B_1 or whose food intake is restricted.—Editorial. Human biosynthesis of vitamin B_1. Brit. M. J. 332, March 4, 1944.

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SOME PRACTICAL ASPECTS OF CIRCUMCISION

MARVIN L. GERBER
Lieutenant (MC) U. S. N.

Circumcision is one of the most commonly performed surgical operations in the Navy. Although considered a minor operation and frequently undertaken by inexperienced surgeons, it is felt that circumcision should be done with care, precision, and caution regarding potential hazards.

The indications for circumcision are controversial and medical officers are likely to wonder if they are justified in doing an elective procedure during wartime. At a relatively inactive foreign shore station the candidates for surgery are numerous; the men seem to feel that it is an excellent opportunity to have the surgery performed without loss of time.

OPERATIVE PROCEDURE

The patient is instructed to have a light or liquid breakfast on the morning of operation and to report to the dispensary with the genitalia shaved and cleansed. On admission the preparation is checked by the corpsman and the patient again washes thoroughly with soap and water. He is put to bed and given 3 grains of a rapidly-acting barbiturate, such as seconal or pentobarbital, 1½ hours before surgery. Morphine is considered unnecessary.

Procaine hydrochloride in 2-percent solution has been used as a regional block anesthetic with consistently satisfactory results; no epinephrine is used in the solution because of the danger of resultant ischemic gangrene. Spinal or general anesthesia is considered an unnecessary risk and prolongs convalescence; the disadvantages of local infiltration at the operative site in producing distortion of the tissues and postoperative edema are well known. Block anesthesia is quick, effective, and safe.

1. An intradermal wheal is made at the base of the penis in the dorsal midline, and a few cubic centimeters of the anesthetic solution are injected into the subcutaneous tissue on each side.

2. The point of the needle is then directed between the corpora cavernosa and the region of the dorsal nerve infiltrated with about 3 cc. of the solution.

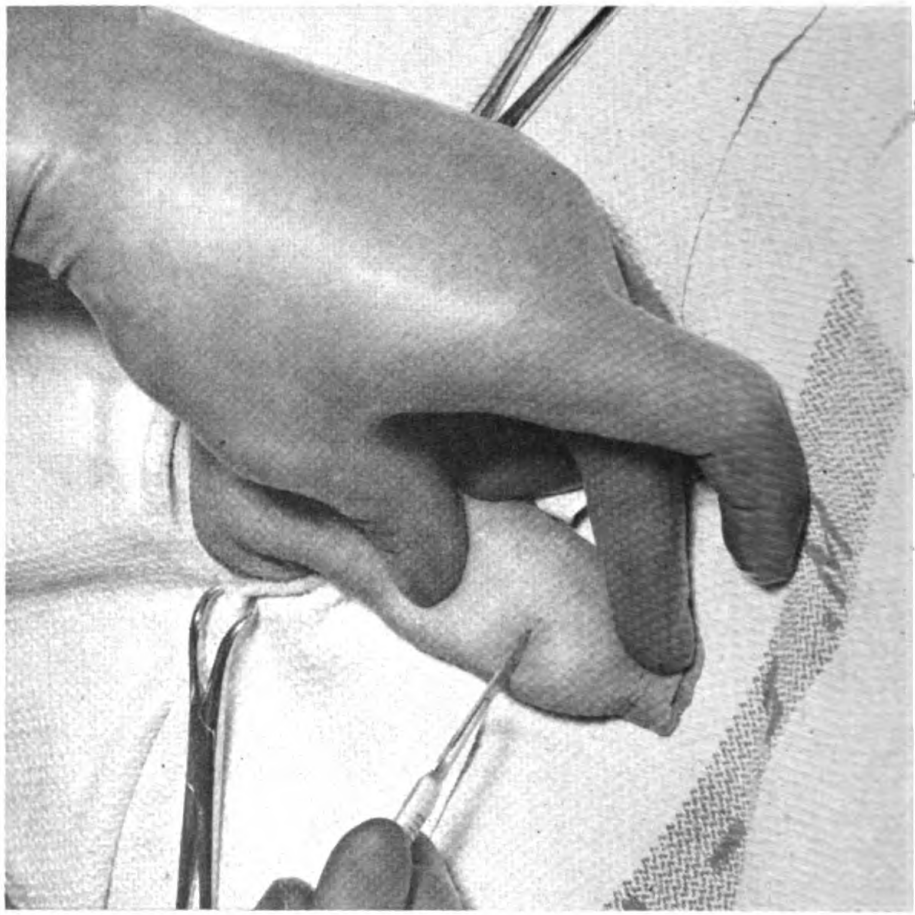
3. Another wheal is made at the median raphe at the junction of the base of the penis with the scrotum, and the subcutaneous ring of fluid completed.

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4. The point of the needle is directed between the corpus spongiosum and corpus cavernosum on one side, and the nerve running in this groove is bathed in 3 cc. of the anesthetic.

5. The procedure is repeated for the ventral nerve on the other side.

6. Anesthesia is complete and usually instantaneous, but may be hastened if necessary by a little massage at the base of the penis.



Small transverse incision used as a guide on dorsum of prepuce.

The technic of operation varies somewhat with every surgeon, and the method described herein has been the natural evolution of trial and error over a period of time. Each step is carried out carefully, deliberately, and gently:

1. A small transverse incision is made on the dorsum of the prepuce just distal to the coronal ridge; this is to serve as a guide (see illustration).

2. The tip of the prepuce is grasped with three hemostats, one in the dorsal midline and one on each side of the ventral median raphe.

3. Traction is made, and sharp straight scissors are introduced between the two ventral hemostats.

4. With these the prepuce is cut as far as the attachment of the frenulum, care being taken to go no farther.

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5. Traction is continued and the foreskin removed by cutting along an imaginary line from this point around to the dorsal guide mark, first on one side and then the other. No dorsal slit is used.

6. Bleeding is controlled by clamping the cut vessels with mosquito forceps and ligating them with No. 00 plain catgut. A tourniquet is considered unnecessary. A silk mattress suture is placed at the frenulum, and the skin apposed to mucous membrane with interrupted fine silk (or cotton) at short intervals. Care should be taken to avoid inversion of the wound edges, and the sutures should be tied loosely. Vaseline gauze is used only for the first dressing.

POSTOPERATIVE COURSE

1. The patient is allowed to remain in bed for 24 hours postoperatively and then put on the light duty list for a week.

2. Pain or bleeding has not occurred in this series.

3. The dressing is changed only when it becomes soiled or loose, at which time sulfathiazole powder is blown about the wound edges.

4. Sutures are usually removed on the 6th postoperative day.

5. Nocturnal and early matinal erections are troublesome until the sutures are removed, but can usually be controlled by adequate doses of a suitable barbiturate at bedtime.

PENICILLIN IN DENTISTRY

Local treatment with penicillin has proved successful in mastoiditis, blepharitis, chronic conjunctivitis and chronic wound sinuses. With this clinical evidence and the knowledge that penicillin will destroy staphylococci, streptococci and pneumococci when applied locally, it is reasonable to assume that such dental disorders as periodontoclasia, osteomyelitis, Vincent's infection, apical granuloma and dry socket infections will be successfully treated with this drug.

There are several salient features of penicillin therapy which make it particularly applicable to dental use: (1) Its potency against sulfonamide-resistant bacteria, especially the staphylococcus, (2) its activity in the presence of serum and pus, (3) its successful application in treating closed cavities and sinuses and other reported cases analogous to those found in dental disease, (4) its action on lactobacilli and (5) its ability to act when applied topically.

All these features indicate that penicillin will have a prominent place in the drug armamentarium of the dentist.—CIPES, L. R.: Penicillin in dentistry. J. Am. Dent. A. 31: 201–204, February 1, 1944.

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FEAR

Fear is a universal human reaction biologically justified by the protection it provides for the individual in the event of danger. It is an emotion experienced when an individual is confronted with a definite threat to life and limb. With the experiencing of fear, there is set in motion a large number of visceral phenomena, the sole purpose of which is to help the person escape or combat danger. Not all persons respond in the same way to fear-producing situations.

While fear is thus experienced in the presence of a definite danger, and we might say the degree of fear experienced is exactly proportional to the degree of danger present, instances are observed when the objective cause of fear appears negligible, yet the fear reaction may be so marked as to virtually precipitate a panic. Such a fear, which is wholly out of proportion to the stimulus, partakes thus of the nature of a neurotic reaction, and we speak of these as "phobias."

Simple phobia is a conditioned reaction due to some early "unpleasant" experience.

Complex phobia is one associated with a conflict that has been "repressed" or buried in the unconscious. The patient protects himself or herself from the "real" fear by taking on a "substitute" fear.

There exist as many phobias as there are fears. Each has a specific name. The Greek prefix in many cases gives one a clue as to the nature of the fear. For example, syphilophobia, as one would surmise, means a morbid fear of syphilis; microphobia, a fear of microbes; cardiophobia, a fear of heart diseases, etc.

Phobias are "substituted emotions." They are sometimes spoken of as "repression neuroses." The abnormal fear represents a symbol of something that is unpleasant and that has been repressed. In other words the phobia serves a definite function. It is intended to disguise or displace an entirely different fear, one which is too painful to our consciousness.—CAPRIO, F. S.: Morbid fears. M. Ann. District of Columbia 13: 98–101, March 1944.

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SEDATIVE ACTION OF DEMEROL

The sedative action of Demerol is of no great clinical significance or usefulness. If the dose is sufficiently large, it acts as a hypnotic, but the patient is easily aroused. It has no after-effects, but, oddly, tolerance to the sedative action is rapidly acquired. Its possibilities as a preanesthetic drug have been considered. Demerol does not depress the cough center, therefore it cannot replace morphine or codeine as a cough depressant.—QUICK, A. J., and TATUM, A. L.: Comments on treatment. Wisconsin M. J. 43: 326, March 1944.

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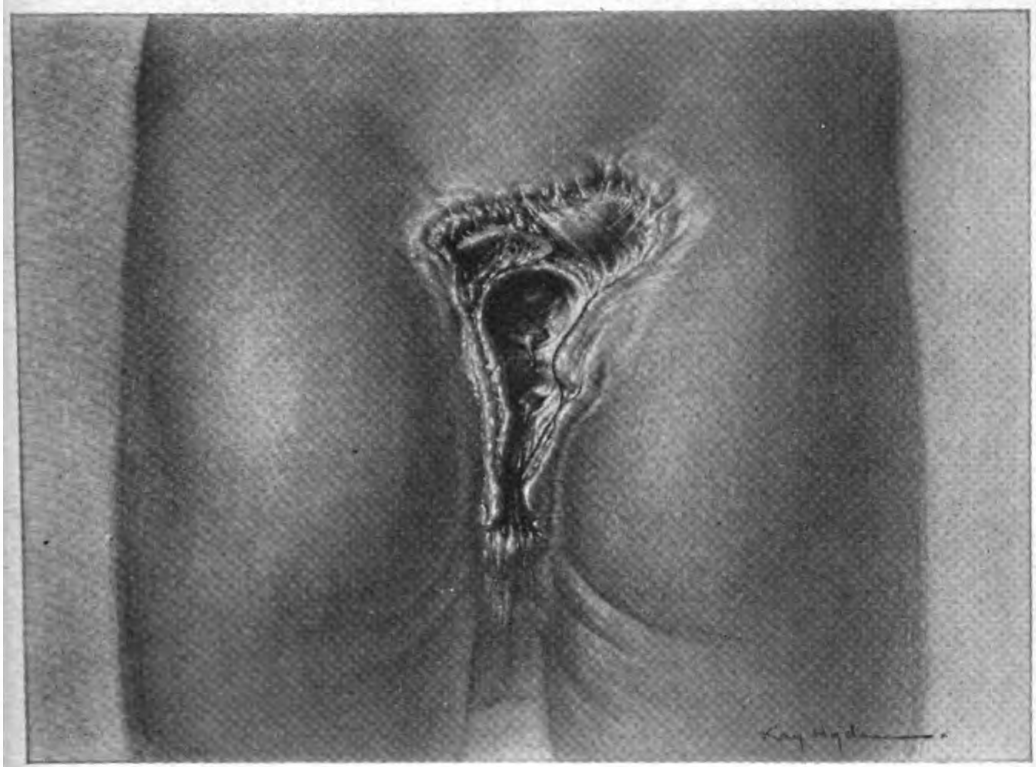
CLINICAL NOTES

RESTORATION OF THE RECTUM

JOHN B. HARTZELL
Lieutenant Commander (MC) U. S. N. R.

In this combat injury case there was an extensive loss of tissue from the posterior rectal wall, and marked scar formation. Plastic reconstruction was made possible by diverting the fecal stream with a double-barreled colostomy.

Case report.—The patient, 22 years of age, while in action against the enemy on Guadalcanal, 14 September 1942, was struck in the left groin by a 30-caliber bullet which passed through the urinary bladder and rectum and emerged

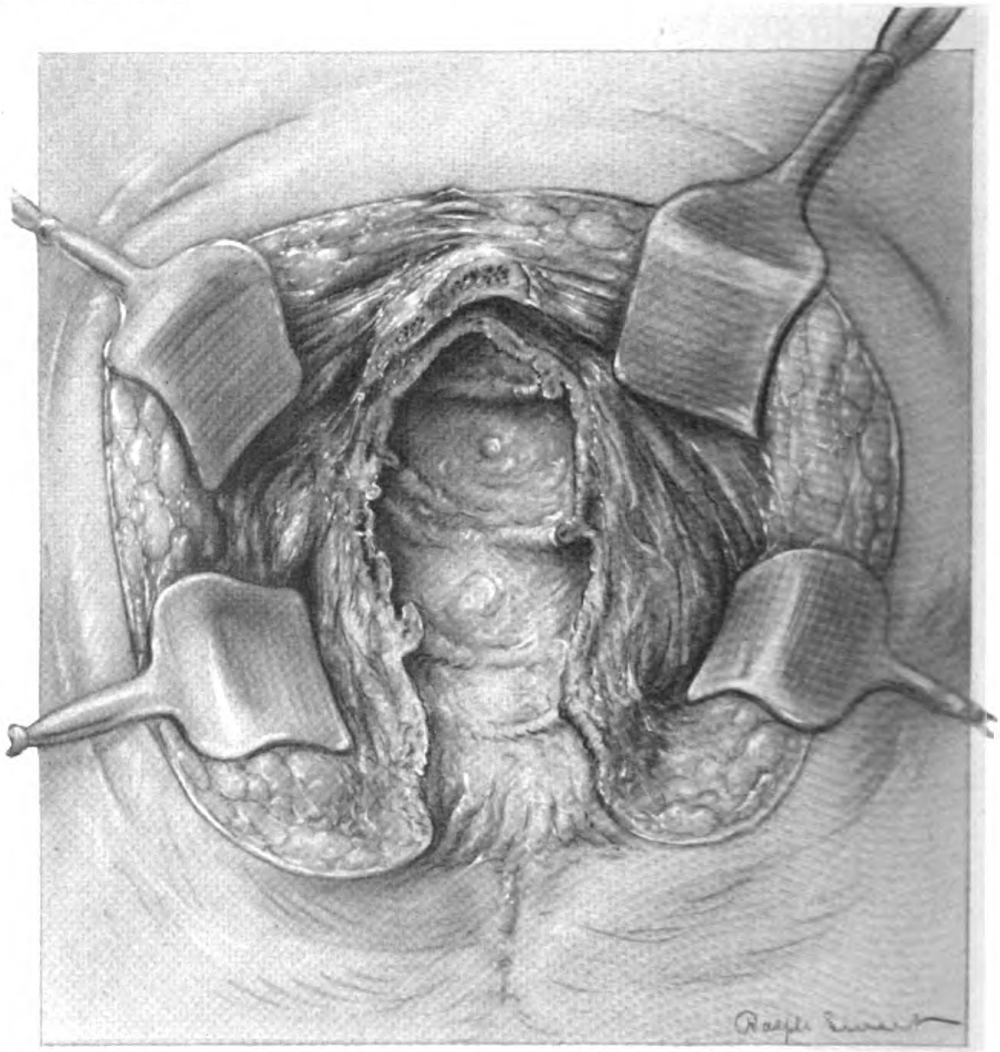


1. Condition of injury, showing loss of posterior rectal wall prior to plastic repair.

through the sacrum. He was taken to the dressing station within 30 minutes and then to a field hospital where he received a transfusion of plasma. The following day he was evacuated by air to a base hospital where inspection revealed the anterior wound to be small and clean, while the posterior wound was about 4 to 5 centimeters in diameter. It appeared macerated and drained copious amounts of urine and feces.

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Under spinal anesthesia the posterior wound was explored, and several large fragments of the sacrum were removed together with the entire coccyx. The wound was left open. A cystogram revealed a perforated bladder and a suprapubic cystostomy was performed. The subsequent course was uneventful and in 10 days the patient was transferred to a hospital in New Zealand. The perforations in the urinary bladder had healed and the patient was voiding through the urethra. The cystostomy wound was allowed to close without further surgical interference.

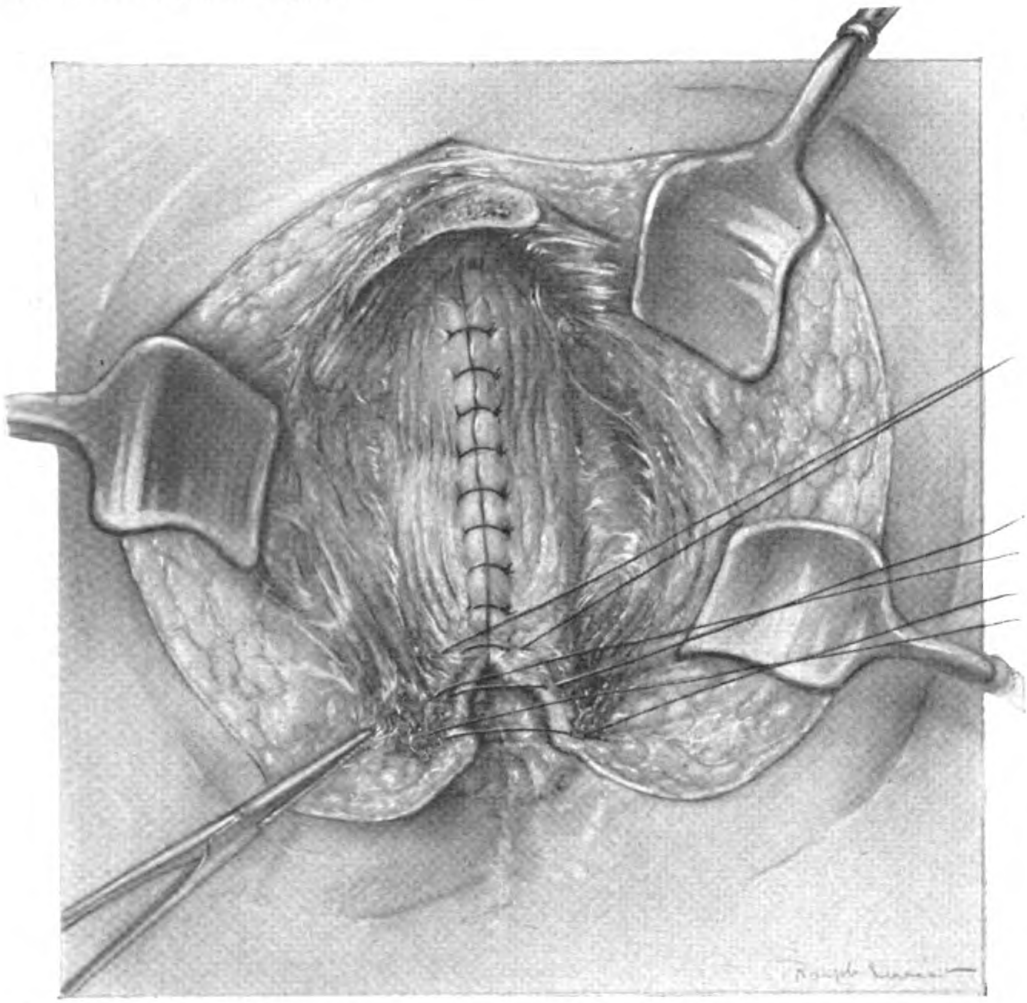


2. The rectum was separated from the sacrum and freed laterally and posteriorly up to the peritoneum.

The patient was transferred to the mainland and admitted to this hospital one month after injury. He showed marked loss of weight and there was a copious drainage through the rectal fistula. Daily sitz baths were ordered. An acute orchitis developed, however, and later a toxic jaundice which delayed any planned radical treatment. During this interval the opening decreased in size but continued to drain.

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Two months later the fistula was explored, a dissecting abscess being found between the rectum and the levator muscles, extending to the internal sphincter. As much of the fistulous tract as possible was excised and the internal and external sphincter muscles were severed. The active infection subsided to some extent but the granulations remained unhealthy. The patient was forced to wear a pad held tightly in place with a T-binder. The infection precluded any attempt at successful plastic repair.

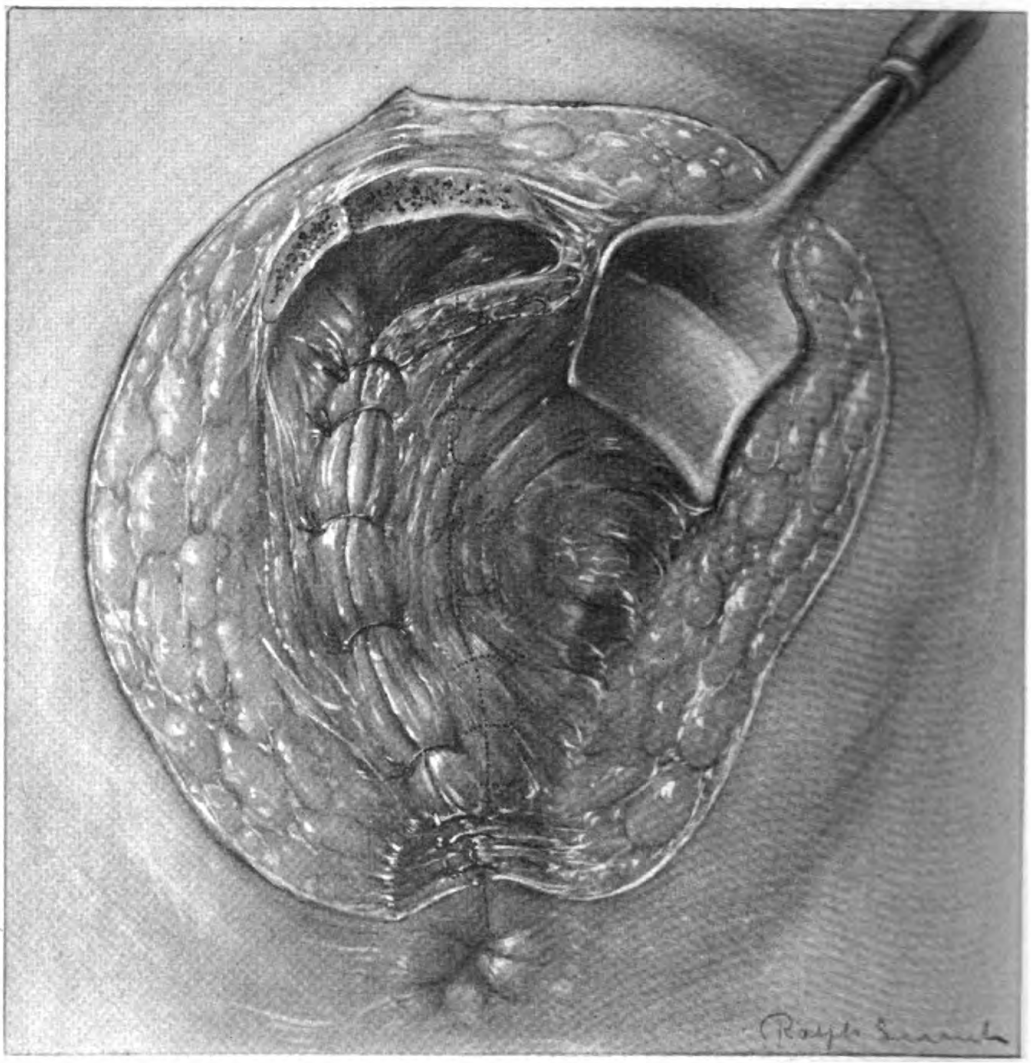


3. The margins of the rectum approximated with interrupted inverting catgut sutures.

A double-barreled colostomy was performed the following month. The infection rapidly cleared and in 3 weeks the wound appeared as shown in figure 1. Four weeks later an operation for repair of the rectum, anus, and sphincters was performed. The skin about the anus was separated from the mucous membrane and the scar tissue was excised. The rectum was separated from the sacrum and freed laterally and posteriorly up to the peritoneum (fig. 2). The margins of the rectum were then approximated with interrupted inverting catgut sutures as shown in figure 3. The right levator ani muscle was dissected and

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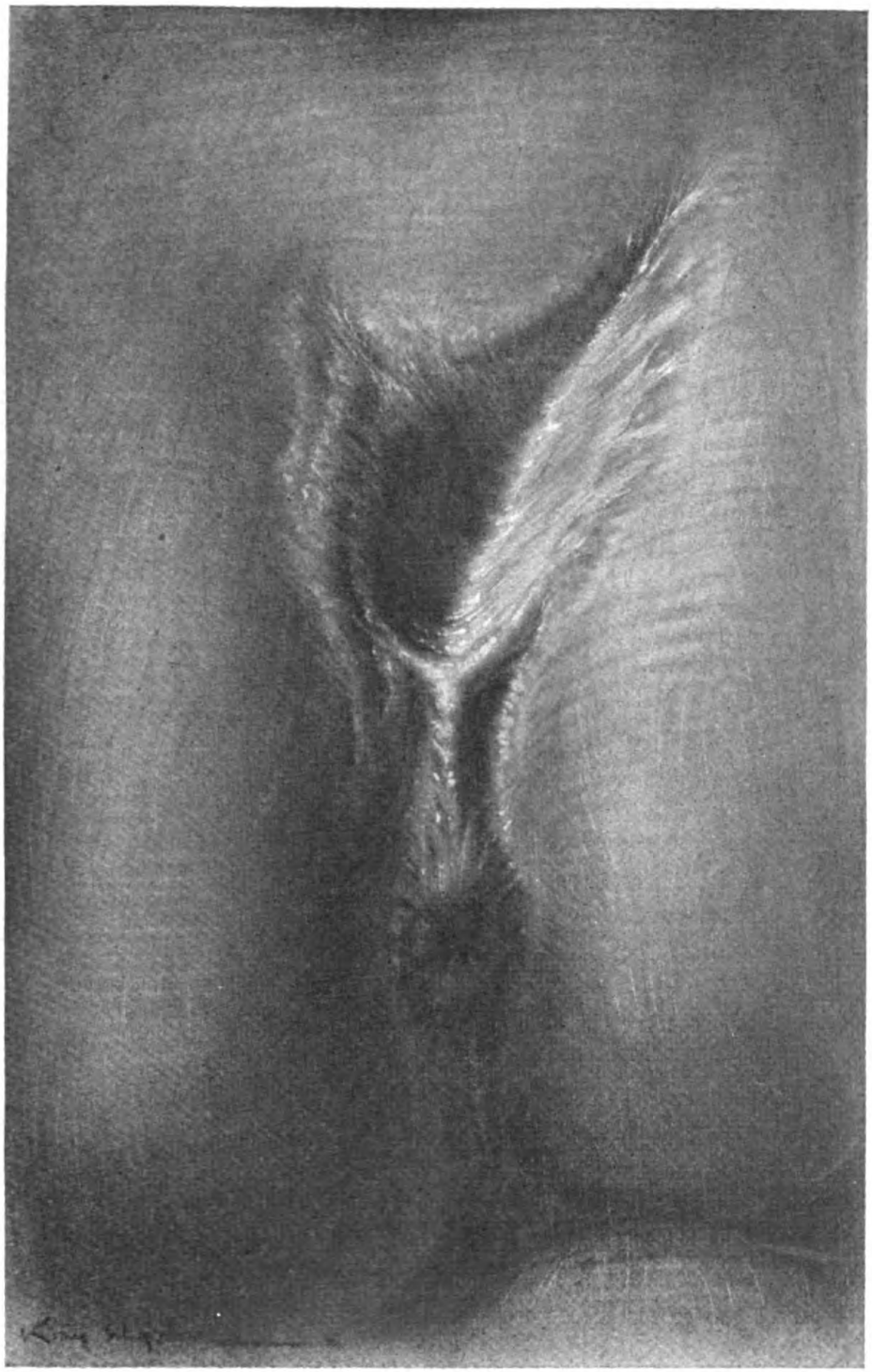
the fibers partially transected as high as possible to permit sufficient mobilization for closure over the suture line in the rectum and imbrication beneath the levator ani on the left side (fig. 4). The sphincter was then repaired and the skin loosely approximated. A large dead space remained between the levator muscles and sacrum. This cavity was packed with sulfa ointment and gauze. A pack was also placed in the rectum to maintain gentle pressure upon the suture line.



4. The right levator ani muscle was freed and partially cut across as high as possible, allowing its free border to be brought over the suture line in the rectum and imbricated beneath the levator ani on the left side.

After 1 week the packs were gradually removed. The cavity beneath the upper portion of the sacrum was irrigated daily and daily sitz baths were

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5. Ten weeks later the cavity had filled in and the wound was closed.

instituted. Ten weeks later the cavity had filled in and the wound was healed (fig. 5). The action of the rectal sphincter was excellent. The colostomy was then repaired. Following convalescent leave the patient was returned to duty.

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TREATMENT OF MENINGOCOCCIC MENINGITIS

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The susceptibility of the meningococcus to sulfonamide therapy is so well established that it needs no special comment. The best and safest method of administering such therapy, however, is still subject to discussion.

Only five patients with meningococcic meningitis were admitted to this hospital in the first 7 months of 1942; all five recovered. Sulfathiazole was employed in moderate dosage, 4 gm. on admission and 1 gm. every 4 hours thereafter. These patients were only moderately ill, rarely comatose, and convalescence was prompt and complete.

In the following 3½ months 33 proved cases of meningitis were admitted. Thirty-two cases were of the meningococcic type, while one was due to a primary pneumococcic Type 19 infection. There were 2 deaths, a mortality of 6 percent. Many of these patients were extremely ill on admission, and the 2 deaths occurred in cases exhibiting the Waterhouse-Friderichsen syndrome.

A treatment routine was evolved in these cases which has many advantages. Sulfonamides were used to the exclusion of all other specific therapeutic agents.

The majority of patients had all or most of the typical diagnostic features such as rigid neck, positive Kernig and Brudzinski signs, headache, vomiting, macular eruption, etc., together with increased intrathecal pressure and turbid spinal fluid with greatly increased cell count and demonstrable Neisseria intracellularis.

Our therapeutic methods differed somewhat from those most commonly employed. Sulfonamides were given *intravenously* in all cases regardless of the apparent degree of illness. This is of the greatest importance. Many therapists rely solely on oral medication except in the case of the uncooperative or comatose patient. Although oral therapy is effective in the majority of cases, it should be borne in mind that meningitis is a virulent and treacherous disease and grave manifesta-

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tions may occur very suddenly. In oral therapy there is an indefinite latent period before the drug can be absorbed even under normal conditions. In meningitis the possibility of gastric hypersecretion and vomiting greatly increase this uncertainty, and in the interim precious time is lost. We have seen apparently slightly ill individuals become violently sick so rapidly that it has become our practice to have therapeutic equipment ready for use even before the patient reaches the ward. Laboratory diagnostic procedures are expedited and reports returned immediately.

The routine intravenous therapy consisted of sodium sulfadiazine, 5 gm. in 200 cc. of sterile distilled water, given on admission and repeated every 6 hours, day and night, until the patient had passed the crisis and proper blood levels of the drug could be maintained by oral intake. Each morning the blood level was determined so that a concentration of between 10 and 20 mg. percent could be maintained. In one case a level of 55 mg. was obtained without evidence of toxicity. In this series the oral route of medication was substituted after an average of 3 intravenous injections. The clinical response of these patients to therapy was on the whole remarkable.

The incidence of sulfonamide reactions in this series was markedly low, probably attributable to the large intake of fluids. Each intravenous administration of a sulfonamide was followed by a liter of normal saline solution intravenously. A urinary pH of 7.5 or higher was maintained by means of alkalinizing agents. By this method serious urinary complications were avoided.

Many febrile patients showed signs of meningeal irritation. Many times the symptoms of headache, nuchal rigidity, nausea, positive Kernig's sign, etc., are so slight as to seem not to warrant a lumbar puncture. In such cases treatment with sulfonamides by the oral route was carried out.

One patient with fatal Waterhouse-Friderichsen syndrome reported to the sickbay with typical catarrhal fever symptoms—a slight fever, general malaise and weakness. On examination he was not considered sufficiently ill to be admitted to the hospital. He was given aspirin-phenacetin-caffeine capsules and admitted to the dispensary for the night. The next morning his symptoms had become pronounced and a rash had appeared over his body. He was hospitalized immediately and on arrival was in a state of toxemia with tachycardia, hypotension, cyanosis, and extreme dyspnea.

The patient was conscious and cooperative and there were no signs of meningeal irritation. The spinal fluid contained only 8 cells, all lymphocytes, and no organisms. He was given cardiorespiratory stimulants, plasma and sodium sulfadiazine intravenously, and was

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placed in an oxygen tent. Nevertheless he failed to rally and expired 2 hours later. Meningococci were found abundantly in postmortem blood smears. Autopsy revealed markedly hemorrhagic adrenals and showed the meninges to be free of any involvement. A complete report of this case has been published.[1] Early therapy would probably have been effective.

Each of the fatal cases was definitely a meningococcemia, with marked peripheral collapse and death within a few hours after onset of the disease. It is felt that prompt sulfonamide therapy in all cases of acute catarrhal fever and allied upper respiratory infections will avert similar catastrophies. Such a procedure was instituted at this activity after the fatality described occurred.

[1] HUMPHREY, A. A., and TOOMEY, L. O.: Meningococcemia with Waterhouse-Friderichsen syndrome; early recognition by means of buffy layer smears. U. S. Nav. M. Bull. 42: 165–168, January 1944.

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BLOOD-PRESSURE READINGS DURING OPERATIONS

By taking the blood pressure every five minutes during operations surprising falls and variations have been found, irrespective of the type of procedure, whether major or minor. They occur with all sorts of anaesthesia—a statement based on thousands of readings during the period 1933–43. The variations in pressure are wide during spinal anaesthesia, somewhat less with general anaesthetics, and much less with local infiltration of novocain or amethocaine hydrochloride (decicain). The progress of the blood pressure is unpredictable. A severe fall in blood pressure is not regarded as an indication of shock, but, taken with other factors, it is helpful.—DODD, H.: Significance of blood-pressure readings in general surgical work; with special reference to cardiac index. Brit. M. J. 2: 811–813, December 25, 1943.

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PROCAINE TOLERANCE

A POSSIBLE CAUSE OF ANESTHESIA FAILURE
REPORT OF A CASE

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Spinal anesthesia has gone through a period of controversy but today it is universally recognized as a valuable adjunct to the armamentarium of the surgeon and anesthesiologist. Acceptance of this type of anesthetic may be attributed in part to the improved technic of spinal puncture, the use of less toxic alkaloid preparations, and the administration of vasoconstrictor drugs.

Intraspinally cocaine and its derivatives act by bathing the tissues of the intradural space. The nerve roots, which quickly absorb the agent, are anesthetized, preventing the passage of sensory and motor impulses. The first fibers to be paralyzed by this action are those of the sympathetics, followed by the sensory and lastly the motor elements. The extent of vasomotor paralysis is greater than the area in which pain response is abolished. The return of function, after the effect of the anesthetic agent has been exhausted, is in reverse order.

The success of spinal anesthesia is dependent on many factors, most important of which is the suitable concentration of the anesthetic agent and its contact with the nerve trunks. If precautions to insure proper administration of the anesthetic have been taken success is fairly certain, but there will invariably be some failures. Too often the anesthetist is blamed for a poor result when the fault lies elsewhere. A cause for failure of spinal anesthesia that has received insufficient attention is a tolerance to cocaine and its derivatives. The following case exemplifies such a tolerance.

CASE REPORT

A seaman, first class, 37 years old, complained of increased swelling in the right inguinal region accompanied by pain which was increased by straining. Examination revealed no abnormalities except a small right direct inguinal hernia, and herniorrhaphy was advised.

Following adequate preoperative preparation (nembutal, 1½ grains, 1½ hours before operation, and morphine sulfate, ¼ grain, with atropine sulfate, 1/150 grain,

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45 minutes before operation), the patient was brought to the operating room and after injection of ¾ grain of ephedrine sulfate intramuscularly, 150 mg. of novocain was injected into the subarachnoid space at the 4th lumbar interspace with the patient lying on his left side.

The patient was turned to a supine position and the table adjusted to a 10° cephalic declination for 10 minutes and then raised 5° and kept in this position. There was no circulatory collapse, nor was there any motor nerve involvement. The only sensory change was a decrease in pain sensation over a small area of skin on the anteromedial aspect in the distal third of the left thigh. It was thought that the anesthetic solution used had deteriorated and lost its effectiveness, so the operation was deferred until the following morning.

After the same preoperative preparation the next morning, the same technic was used. With the patient on his right side, 18 mg. of pontocaine hydrochloride was injected into the subarachnoid space through the 3d lumbar interspace. The table was inclined as before but again anesthesia was incomplete. There was a small area of sensory anesthesia over the right thigh with diminished response to tactual, thermal, and pain stimuli, but there was no evidence of muscle paralysis nor was there any sign of circulatory collapse. The patient was returned to the ward for observation.

Two days later the patient was again prepared for herniorrhaphy, and local infiltration of novocain was done without success. Procaine hydrochloride in 2-percent solution was then used over a rather extensive infiltration area, but the response to pain stimuli could not be sufficiently abolished, and it was necessary to perform the operation under ether inhalation anesthesia.

COMMENT

There were three failures in the production of anesthesia, two intraspinally and one locally. The novocain crystals, 2-percent procaine hydrochloride solution, and pontocaine hydrochloride had been used previously in other patients with consistent success, thus tending to prove that the failure was not caused by an inert anesthetic agent. To prove that the technic was not at fault, 150 mg. of novocain was placed in the subarachnoid space of this patient through the third lumbar interspace, and after the needle was withdrawn a second puncture was made at the fourth lumbar interspace. Spinal fluid collected from the second puncture for laboratory analysis showed the presence of procaine of adequate concentration.

As further proof that this was a case of procaine tolerance several other procedures were employed. Injection of the long buccal nerve and the infra-orbital nerve with a 2-percent solution of novocain was attempted by the dental officer but the resultant anesthesia was incomplete.

In one procedure in which 150 mg. of novocain was used, the patient remained on his left side and the table was inclined 10° caudally so that the solution remaining in the subarachnoid space would be concentrated over a smaller area of nerve tissue. In 6 minutes the left foot was appreciably warmer than the right and sensory changes were demonstrable. Anesthesia for pain and thermal stimuli

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was produced to the level of the midthigh, and motor paralysis was evident in that the patient was unable to move his left leg. There were no changes in the right leg or thigh. This demonstrated that if a sufficient concentration of the anesthetic could be placed in direct contact with the nerve fibers, partial anesthesia would occur, but in this case the response was less pronounced than usual. This finding is not in agreement with Koster (*1*) who states that procaine does not gravitate to dependent portions of the subarachnoid space.

That tolerance to cocaine and its derivatives is a cause of anesthesia failure cannot be denied, but in what percentage of cases it is responsible for failure and to what degree such tolerance influences results remains to be proved. Hand (*2*) in a recent article on the factors influencing the success of spinal anesthesia failed to mention procaine tolerance, which indicates that this factor is not adequately considered as a cause of failure.

Sebrechts (*3*) expressed the opinion that resistant patients are a sympatheticotonic type, while those who are sensitive to cocaine and its derivatives are a "hypervagotonic" type. He believed procaine tolerance to be familial and reported 5 such cases in 1 family. He also suggested that resistance is racial and is encountered more frequently in Anglo-Saxons. Black and Walters (*4*) in a series of 600 cases found 2 resistant to the effects of cocaine derivatives, and in 1 case decicain, durocaine, and nupercaine were employed without success. They have applied the term "rachiresistant" to this particular type of individual. Barney suggested that since some individuals are hypersusceptible to procaine, it would be logical to assume that others are hyposusceptible.

Lemmon (*5*) stated that one patient may require more procaine hydrochloride intraspinally to produce analgesia than does another. In 200 cases of continuous spinal anesthesia there was no instance of failure of the anesthetic, although a second injection was sometimes necessary, and in one case a third injection before anesthesia was sufficient to start the operation. Further investigation to clarify the role of procaine tolerance in anesthesia would appear to be indicated.

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3. SEBRECHTS, J.: La rachianesthésie. Rev. belge sc. méd. **6**: 312–334, April 1934; also, Spinal anaesthesia. Brit. J. Anaesth. **12**: 4–27, October 1934.
4. BLACK, W. R., and WALTERS, G. A. B.: "Rachiresistance" and spinal anaesthesia. Brit. M. J. 218–219, January 30, 1937.
5. LEMMON, W. T.: Method for continuous spinal anesthesia; preliminary report. Ann. Surg. **111**: 141–144, January 1940.

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SEVERE BURN: CASE REPORT

NOTES ON ABNORMAL NITROGEN METABOLISM

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Recent studies on the therapeutic management of the burn patient have emphasized the importance of numerous underlying physiologic, metabolic and clinical factors that should constantly be kept in mind. The following case demonstrates the necessity of maintaining nitrogen balance in the patient with extensive burns and infected granulating body areas.

CASE REPORT

A Marine officer, 28 years old, was burned extensively over the face, neck, hands, ears, arms, forehead, legs, and feet in an airplane accident early in 1943. An estimated 40 percent of the body area was burned. A considerable part of the full thickness of the skin over the left ankle and almost all of the skin of the right leg from the middle of the thigh to the ankle was destroyed. One month after the accident the patient was transferred to this hospital in poor condition, suffering from pain, dehydration, and malnutrition. He was placed on a high cystine-protein diet and large amounts of vitamins A, B, C, and D. During this time he received several transfusions of whole blood.

Three months later there was only moderate epithelization. Cultures of the granulation showed only Staphylococcus albus, so skin-grafting was advised. Split-thickness grafts were taken and sutured in place without tension. The first few grafts took fairly well but later grafts failed to take and numerous infections occurred at donor sites and around previous skin grafts. Bacteriologic studies showed pure cultures of micro-aerophilic and anaerobic hemolytic streptococci which responded to treatment with hydrogen peroxide and zinc peroxide. During this time there was a progressive fall in the erythrocyte count and plasma proteins despite repeated blood transfusions, a high-protein diet, ferrous sulfate, and intensive vitamin therapy.

At each plastic operation there was considerable loss of blood from the donor sites and from the granulations. On two occasions the patient developed severe postoperative shock, rallying only upon intensive administration of plasma. At this time he was edematous, the grafts were not growing, and many of them were even receding due to the anaerobic infections. There was a definite bleeding tendency. The erythrocyte count was 3,200,000, blood platelets numbered 425,000, plasma protein was 3.9 gm., prothrombin time was 62 seconds (control), and bleeding time 11 seconds. The patient was placed on a low-salt diet, increased dietary protein (100–150 gm. per day) and vitamin

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K parenterally with 500 cc. of blood and plasma daily. On this regime he began to improve gradually, but further grafting was postponed until all infection, edema, and bleeding tendency had been controlled.

Approximately 2 weeks later the patient was again feeling well, eating voraciously, and there was no edema. The prothrombin time remained normal. Previous grafts and skin edges were proliferating actively, so the skin-grafting was completed. From this time on until the areas were completely healed 2 months later there were no further accidents.

COMMENT

This case illustrates the abnormal nitrogen metabolism of burns and of large infected granulating areas as demonstrated by Taylor (*1*) and his associates. Unfortunately no studies of the azotemia or urinary nitrogen excretion were obtained in this case. Taylor mentioned that at times up to 500 gm. of protein must be administered daily in the form of blood, plasma, albumin and protein hydrolysates. In this case approximately 212 gm. of protein was administered daily for 7 days and the amount of blood and plasma was gradually decreased as the plasma proteins and erythrocyte count increased.

The case further illustrates a depression in red blood cell formation. There were no reticulocytes for a prolonged period. Similarly a marked prothrombin deficiency and a bleeding tendency developed along with the hypoproteinemia and a reversal of the albumin-globulin ratio. All these factors tend to inhibit the growth of skin grafts and are conducive to the development of infections. Factors influencing the skin graft takes have previously been comprehensively discussed by Poth (*2*) whose method was followed in this patient.

The patient received a total of 10,750 cc. of whole blood and 8,750 cc. of plasma, and was under various kinds of anesthesia 43 times. It is believed that skin-grafting should not be attempted unless the erythrocyte count is well over 4,000,000, the plasma protein over 6-gm. percent, and the prothrombin time normal. Thrombin would have been a useful adjunct in both the application of these grafts and in the control of the bleeding (*3*) (*4*). Later experiences with fibrinogen and thrombin will be presented in a future paper.

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SECONDARY SCALENUS ANTICUS SYNDROME

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The occurrence of the scalenus anticus syndrome as a secondary manifestation of certain affections of the shoulder girdle may lead to difficulties in diagnosis and unnecessary scaleniotomy. The primary disturbance has been established on a firm footing by Naffziger,[1] Adson,[2] Ochsner,[3] and others who have shown that the condition is not necessarily contingent upon a coexistent cervical rib, an elongated seventh cervical transverse process, or other congenital anomaly. However it is not so generally appreciated that scalenus anticus pain and the accompanying neurocirculatory changes in the upper extremity may complicate a wide range of clinical pictures. The following case is illustrative.

Case report.—A Marine sergeant entered a hospital for treatment of filariasis involving the arms, groin, and left spermatic cord. A few months later there was a recurrence of this condition with lymphadenopathy of the supraclavicular and posterior cervical nodes bilaterally. A node in the left posterior triangle of the neck was excised for biopsy under local anesthesia. The patient stated that a nerve was touched during the procedure, which caused a sudden upward jerk of the left shoulder. Microscopic examination of the specimen was positive for filariasis and the patient was transferred to the United States.

When the patient was admitted to this hospital the filariasis appeared to be quiescent and there was only slight residual thickening of the left spermatic cord. The major complaints, which had their onset 2 months prior to operation, consisted of pain in the left supraclavicular region radiating down the inner aspect of the left arm, weakness in elevation of the left arm, and numbness over the left shoulder and in the ulnar aspect of that extremity extending into the fingers. He had marked atrophy of the left upper arm. The pain was aggravated by his lifting heavy objects, contralateral rotation and extension of the head, sleeping on his back, and abducting the left arm.

Clinical and laboratory examination showed no abnormalities except a well-healed 3-inch operative scar in the left posterior triangle of the neck. Neurologic examination disclosed motor weakness of the left deltoid, weakness of the lower trapezius fibers and of the left infraspinatus, supraspinatus, and biceps brachii. There was winging of the left scapula, with "falling away" of its medial border from the vertebral column.

Atrophy of the left deltoid was present and the circumference of the left upper arm was 1.2 inches less than that of the right. There was hypesthesia with loss

[1] NAFFZIGER, H. C.: Editorial. Scalenus anticus syndrome. Surg., Gynec. & Obst. 64: 11–120, January 1937.

[2] ADSON, A. W.: Surgical treatment of cervical ribs. Texas State J. Med. 28: 739–747, March 1933.

[3] OCHSNER, A.: Tr. South. S. A. 1934. p. 475.

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of sharp-dull discrimination in the distribution of the left axillary and ulnar nerves. Deep reflexes showed no particular laterality. Scalenus maneuvers were positive in the upper extremity with obliteration of the radial pulse and reproduction of pain. A series of blood pressure determinations averaged 10 to 15 points less in the left arm than in the right. X-ray examination of the cervical spine and left shoulder showed no abnormalities. The picture presented, then, was largely a plexus irritation involving particularly the medial and posterior cords with evident damage to the left spinal accessory nerve.

After consultation it was decided to explore the spinal accessory nerve, to be followed by scaleniotomy if sufficient evidence warranted it. The old wound was reopened and enlarged, and the accessory nerve explored from the border of the sternocleidomastoid muscle to its termination in the trapezius plexus. The nerve was found to be constricted in the periadenitis of a large filarial lymph node and bound down in old scar tissue. There was a fusiform neuroma adjacent to the point of constriction. The nerve trunk was freed and the enlarged node removed, following which a neurolysis was done and the trunk transplanted into a muscle bed formed by stripping the mesial border of the trapezius.

The postoperative course was marked by steady progressive improvement in symptoms. Of particular interest was the rapid return of sensation, paradoxically dependent on functional recovery in a purely motor nerve. Six weeks later abduction and external rotation of the left shoulder were complete, pain had disappeared, and the medial borders of the two scapulae were nearly parallel.

In this case it is believed likely that paralysis of the trapezius had caused sufficient sag of the shoulder girdle to place the scalenus on stretch, with resultant hypertrophy and spasm. This sequence of events can obscure the diagnosis in numerous muscular disorders of the upper extremity, as in anterior poliomyelitis, birth palsies, and the group of muscular dystrophies. Recently scalene symptoms were observed in a patient having the scapulohumeral form of progressive muscular atrophy. These variations of the scalenus anticus dysfunction should be recognized and the syndrome should not be limited to a single diagnostic entity.



THIOUREA AND THYROSTASIS

Thiourea administration caused thyroid hyperplasia in rabbits, even though large quantities of iodine were given simultaneously. Total iodine and thyroxine-iodine analyses, as well as microscopic examination of the thyroids, show that there was a rapid decrease in both thyroxine and non-thyroxine iodine under these conditions. This iodine was promptly excreted in the urine. The inhibition of thyroxine formation indicates that thiourea produced a functional thyrostasis of the thyroid cells.—BAUMANN, E. J.; METZGER, N.; and MARINE, D.: Mode of action of thiourea on thyroid gland of rabbits. Endocrinology 34: 44–49, January 1944.

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UNUNITED FRACTURE OF THE CLAVICLE

REPORT OF CASE

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Failure of union following fracture of the clavicle is probably of much more common occurrence than is generally supposed. In 1937 Berkheiser [1] reported 10 cases, 7 of which were subjected to surgery. In 1941 Ghormley et al.[2] reported the results in 8 cases that had been treated surgically. In less than 18 months of active duty at Naval hospitals, we have encountered 4 cases. Doubtless many others are seen in private practice and clinics, but little reference to them can be found in the literature.

From personal observation, we believe that these ununited fractures, when treated surgically, are usually fixed by means of wire or strong catgut. This type of treatment leaves much to be desired, as the fixation is relatively insecure, and absolute immobilization is not obtained. Berkheiser advises the use of massive osteoperiosteal grafts, fixed by means of strong catgut. He keeps the patient in bed for 2 weeks, followed by plaster fixation for 10 weeks. His 7 operative cases all resulted in bony union. Bone grafts were used in 6 of Ghormley's cases; 5 of these resulted in union. Of the 2 treated without grafting, one was secured with wire, the other with catgut. He advocates absolute bed rest and complete immobilization for a period of 5 or 6 weeks.

A case of ununited fracture of the clavicle, treated by a different method of fixation, in which an excellent result was obtained in a relatively short period of time is here reported.

An officer patient sustained a fracture of the right clavicle, when thrown against a bulkhead during an engagement in the South Pacific. He continued at his station despite his injury, for which he received a decoration, while a patient at this hospital.

He was admitted about 6 weeks after the injury. At this time he was "immobilized" in a plaster of paris figure 8 bandage. This was so loose that he slipped it off daily when taking his shower.

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[2] GHORMLEY, R. K.; BLACK, J. R.; and CHERRY, J. H.: Ununited fractures of clavicle. Am. J. Surg. 51: 343–349, February 1941.

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The clinical and x-ray examinations revealed an ununited fracture of the right clavicle, with considerable overriding and deformity. An additional period of several weeks of immobilization was instituted, but union did not occur. However, the shoulder was not painful and he was released from the orthopedic service in order to receive treatment for a concurrent disability. He returned after several weeks, stating that the shoulder caused him discomfort during and after activity. Definite nonunion of the clavicle was present. This was confirmed by x-ray.

Open operation was decided upon. The site of the nonunion was exposed, all callus and fibrous tissue carefully removed, and the bone ends drilled to open the medullary canal. A four-hole vitallium plate was then readily applied to the superior surface of the clavicle, fixing it in place with deeply threaded, machined screws. Absolute fixation and stability of the fracture were thus obtained. Following closure the arm was placed in a simple Sayre dressing, using muslin instead of plaster. Sutures were removed in 12 days, the arm was placed in a sling and active motion was instituted. Recovery and callus formation occurred rapidly, and the patient returned to his ship in a little less than 6 weeks following operation. The clavicle was solidly united, the shoulder was entirely free from pain and showed no limitation of motion.

This case history is presented because it represents a novel method of treatment for ununited fracture of the clavicle. The method employed gave an extremely satisfactory result. From this experience we are led to feel that the complete immobilization obtained from a metal plate and screws offers noteworthy advantages over other methods of treatment. Prolonged bed rest is not required, nor is plaster fixation necessary. Healing takes place in a relatively short period of time.

TIME ELEMENT IN LOCAL SULFONAMIDE THERAPY

Local sulfathiazole treatment of small experimental wounds heavily inoculated with *Cl. welchii* is effective if instituted within 2½ hours after the organisms have been introduced into the wound. With a delay of 5 hours treatment is ineffective. It is probable that in man accidental infection of this type is always by bacterial spores and that there is a much longer interval between contamination of the wound and actual invasion of the tissues by gas-gangrene-producing organisms, during which interval prophylactic treatment with sulfonamides is likely to be successful.—MAGNER, W., and O'SULLIVAN, M. O.: Sulfonamide treatment of wounds. Canad. M. A. J. 50: 118–123, February 1944.

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YAWS

REPORT OF A CASE APPEARING IN A WHITE MAN

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The occurrence of yaws in the white race, contracted under natural circumstances, is exceedingly rare. Cases in European races have been reported (*1*) (*2*). However as a result of the racial contact precipitated by the present global war (*3*) increased incidence of the disease in white men may be expected.

CASE REPORT

The patient, a medical officer, 36 years of age was on duty on one of the Solomon Islands for 2½ months before admission to this base hospital. During this duty he ran a clinic in which natives were treated for yaws. Six weeks before admission he was bitten on the left fourth finger by what was believed to be a centipede. Little thought was given to the bite but there developed an acute lymphangitis of the forearm and an epitrochlear lymphadenitis, for which sulfadiazine was administered. Seventeen days later, a sloughing, punched-out, ulcerous lesion appeared at the site of the bite, which gradually enlarged and showed no tendency to heal. Shortly afterward a maculopapular eruption developed on the trunk, which was present though fading out at the time of examination.

Three darkfield examinations made on board a hospital ship were reported as positive for spirochetes morphologically resembling Treponema pertenue. A blood Kahn examination performed at this time was four-plus.

Intramuscular injections of bismuth were administered the day after the Kahn report, 3 days later, and 13 days later; each of 0.13 gm.

The past history revealed that during this same tour of duty the patient had had an attack of malignant tertian malaria and diarrhea.

Physical examination on admission revealed a granulating area overlying the dorsum of the middle phalanx of the fourth finger, about 5 mm. in diameter, with moderate surrounding induration. There were enlarged left epitrochlear and axillary lymph glands, with evidence of a lymphatic fibrositis on the anterior surface of the forearm. There was some limitation of extension of the left elbow. The left radius had a visible and palpable periosteal thickening which was tender. There were a few scattered maculopapular lesions on the trunk, with a light brown pigmentation.

The patient's course in the hospital was uneventful, with healing of the finger lesion leaving a residual indurated area about 8 mm. in diameter. There was a subsidence of the lymphadenopathy and better extension of the forearm. The periosteal thickening and tenderness became less evident. An intramuscular injection of iodobismitol 0.36 gm. was given on the 4th hospital day.

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The laboratory data revealed:

Red blood cell count	3,720,000.
White blood cell count	8,600.
Hemoglobin	70 percent.
Polymorphonuclears	44 percent.
Lymphocytes	56 percent.
Urinalysis	Negative.
Malarial smear	Negative.
Kahn test	Four-plus.
X-ray of chest	Negative.

COMMENT

This case is reported because of the rarity of yaws in the white race. The infection in this case was undoubtedly contracted from the contamination of the injured skin surface, caused by the bite of an insect. The occurrence of the initial lesion, with a secondary rash, the finding of spirochetal organisms resembling Treponema pertenue, with a positive Kahn test, the periosteal thickening and tenderness, and the actual contact with known cases of yaws confirm the diagnosis.

REFERENCES

1. SCHAMBERG, J. F., and KLAUDER, J. V.: Study of case of yaws, contracted by American soldier in France. Am. J. Trop. Med. 1: 49, January 1921.
2. STEPHENSON, C. S.: Yaws; with report of case which developed in a temperate climate. Mil. Surgeon 47: 344, September 1920.
3. HAMLIN, H.: Geography of treponematosis. Yale J. Biol. & Med. 12: 29–50, October 1939.

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EXPERIMENTAL HEAT EFFECTS ON NORMAL SUBJECTS

Fifteen normal subjects were exposed for one hour to the hot-air cradle. Intravenous saline was administered to 10 of these, and intravenous plasma to 5.

A progressive rise in pulse rate and venous pressure, together with a progressive fall in arterial blood pressure, was observed in all cases. Symptoms resulted, including nausea, vomiting, dehydration, headache, perspiration, muscular pains, and exhaustion. In certain cases these were severe.

These findings would appear to contraindicate the prolonged use of heat in the treatment of patients suffering from traumatic shock.—KAY, A. W.: Heat in treatment of shock. Brit. M. J. 40–41, January 8, 1944.

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COMPLEXITY IN ANTIBIOTICS

Confusion has arisen from the fact that various microorganisms are capable of producing the same type of antibiotic substance. This has already been demonstrated for the following: citrinin is formed by *P. citrinum* and *A. candidus*; penicillic acid, by *P. puberulum* and *P. cyclopium*; penicillin, by *P. notatum, P. chrysogenum* and *A. flavus*; gliotoxin, by *Trichoderma, Gliocladium* and *A. fumigatus*; spinulosin, by *P. spinulosum* and *A. fumigatus*; and clavacin, by *P. claviforme, A. clavatus* and *P. patulum.*

It should also be mentioned that much confusion in the study of antibiotic substances has arisen from the fact that many organisms are capable of producing more than one type of substance. For example, the second antibacterial factor produced by *P. notatum*, namely, the glucose-oxidase, has been designated as *E. coli* factor, penatin, notatin and penicillin B, and which has often been confused with the true penicillin. *A. fumigatus*, however, apparently tops the list, since it has the capacity of forming four different antibacterial compounds, spinulosin, fumigatin, fumigacin and gliotoxin, the first two of which are closely related.—WAKSMAN, S. A.: Purification and antibacterial activity of fumigacin and clavacin. Science **99**: 220–221, March 17, 1944.

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BAKER'S CYST

There are numerous references in the literature to cysts of the popliteal region. A Baker's cyst is a true herniation through the posterior wall of the joint capsule. To be a true hernia, the sac must be connected with the joint. It must be lined with synovia and connected with the joint by either a normal or abnormal opening.

The syndrome is fairly definite. Usually the hernia develops insidiously. Occasionally, because of trauma or inflammation, an acute effusion occurs and the sac is pushed backward along the path of least resistance. In the early stages, there may be only vague pain and a sense of fullness, which may be intermittent. The symptoms may suggest an internal derangement of the knee . As the cyst increases in size, the swelling extends down the popliteal space, under the deep fascia.

Examination usually shows a soft, non-tender, fluctuant mass along the lateral aspect of the semimembranosus tendon. This cyst must be differentiated from a number of other entities, including lipoma, hyperplastic bursitis, fibrosarcoma, angioma, and arteriovenous aneurysm.

The treatment is palliative or surgical. Injection of a sclerosing material is contraindicated.—KUHN, H. H., and HEMPHILL, J. E.: Baker's cyst: Posterior herniation of knee joint. **Radiology 42:** 237–240, March 1944.

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MEDICAL AND SURGICAL DEVICES

I. DRIED PLASMA SHEETS IN TREATMENT OF BURNS II. IN TREATMENT OF WAR WOUNDS

PRELIMINARY REPORTS

BENJAMIN POLLOCK
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I. BURNS

In this war high explosives and mechanization have greatly increased the incidence of burns. It has often been said that this is a "burn war." The urgent need for an ideal coagulum for burns has been stressed many times. It is the purpose of this paper to introduce a new method of treating burns that apparently overcomes many of the objections found with tannic acid, triple dye and other coagulants.

The ideal coagulum should be durable, noncontractile, indefinitely pliable, nontoxic, nonirritant, resistant to trauma, bactericidal, painless, not unsightly, and should contain fibrin. In addition it should be made from materials easily obtained and of low cost.

Dried plasma sheets, from the preliminary work done, apparently come closer to fulfilling these criteria than any other coagulum introduced. Dried plasma when dissolved in water and dried in a hot oven gives a transparent, slightly elastic adherent coagulum. The addition of sulfanilamide or sulfathiazole powder increases its bactericidal qualities. The sulfonamides are held intact in the coagulum and are liberated slowly as the fibrin is utilized, thereby keeping the wound clean indefinitely.

The plasma sheets were made in a Petri dish, giving a sheet 4 inches in diameter, though of course they can be made any size. The following method was employed:

> To 20 cc. of sterile water in a Petri dish, 1.5 to 2 gm. of dried plasma are added and dissolved, and then 0.2 gm. sulfanilamide powder. This preparation is dried in an oven at 140° C. until a firm sheet forms. This drying process requires 15 to 20 minutes. It is then allowed to cool and is applied directly to the burn.

The plasma sheet can be made quickly by heating the preparation over a Bunsen burner until the sheet separates itself from the dish. This requires less than 5 minutes. The plasma sheet is applied to

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the burned area after debridement. Plasma loss is immediately stopped.

The thickness of the plasma sheet can be increased or decreased by raising or lowering the quantity of the water or plasma used. The transparency of the sheet increases or decreases with the amount of sulfonamide powder that is used. By drying this mixture for only 10 minutes it has the consistency of a paste, which is also effective.

In the preliminary work done it was felt that second-degree burns should have layers of tissue paper thickness, and deeper wounds should have thicker layers. The plasma sheets tend to curl at the edges, as does skin when removed from the body. This curling can be overcome by moistening the sheet with water before applying. Within a few moments the plasma sheet becomes adherent and within a few hours strands of fibrin can be seen securing the plasma sheet to the burn almost as if the burn were "fibrin hungry." No dressing need be applied. The plasma sheet appears to have selective qualities. It will adhere to second- and third-degree burns but not to unbroken skin.

The plasma sheets can be preserved for a period of weeks by keeping them moistened with water in a refrigerator. Another method of preservation is to heat the mixture until all the moisture has disappeared. This leaves dry crisp sheets. These can be stored without refrigeration.

When first applying the plasma sheet the patient may complain of a burning or stinging sensation, usually lasting only 1 or 2 minutes, but possibly as long as 30 minutes.

SUMMARY

1. A dried plasma sheet which overcomes most of the objections to ordinary coagulums is suggested.

2. Plasma loss is stopped immediately.

3. Dressings may be used but are not essential.

4. The limited number of cases in which this was tried gave gratifying results.

5. An objection to its use is the stinging or burning sensation when first applied.

II. WAR WOUNDS

In the preceding part of this report the use of dried plasma sheets in the treatment of burns is discussed. The following concerns recent experiences acquired in the treatment of indolent, ulcerating, slow-healing war wounds. The rapidity with which these responded was most gratifying and has prompted a preliminary report at this time.

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After two months of daily dressings and various applications, sulfonamide-impregnated sterile plasma sheets were tried. The results are reflected in the summary of the following four cases.

CASE REPORTS

Case 1.—A Marine private, aged 22 years, wounded at Tarawa by a shell fragment was treated with various applications for 60 days. The wound however remained unhealed. Finally a plasma sheet was applied and the wound healed in 7 days.

Case 2.—Another Marine private, of the same age, was wounded in the same engagement. One week later his wounds were sutured but several days later they reopened. After treatment for 60 days with various applications the wounds remained unhealed. Resort to plasma sheets resulted in complete healing of the wounds 6 days later.

Case 3.—A Marine, wounded at Tarawa by a bullet was treated for 60 days with various applications, despite which the wound remained unhealed. Nine days after applying the plasma sheets the wound was definitely healed.

Case 4.—A carpenter's mate, third class, aged 45 years, was burned with hot coffee. After treatment for 56 days with various applications the burn was unhealed. Plasma sheets were finally applied and in 9 days the burn was nearly healed.

COMMENT

All these wounds were infected. Within 48 hours after the application of the plasma sheet there was a subsidence in the tissue reaction surrounding the wounds. None of the patients was confined to bed and some took daily showers without any attempt to protect the crust that formed. The routine followed in the management of these wounds was the application of dry dressings only at night. Large indolent ulcers of long standing, and donor skin-grafting areas also responded well to this treatment.



POSTOPERATIVE SCALENUS ANTICUS SYNDROME

The syndrome of neurocirculatory compression by lesions of the scalenus anticus muscle may result from the faulty positioning of the patient on the operating table. Injury to the scalenus anticus muscle may be caused by shoulder braces when the patient is maintained in Trendelenburg position, especially when one arm is abducted for intravenous fluid administration and when the head is hyperextended during the administration of the anesthetic.—POMMERENKE, W. T., and RISTEEN, W. A.: Scalenus anticus syndrome as complication after gynecologic operations. Am. J. Obstet. & Gynec. 47: 395–401, March 1944.

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USE OF FRACTIONAL SPINAL ANESTHESIA AT A MOBILE HOSPITAL

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Fractional or continuous spinal anesthesia is becoming more widely used in military surgery. It however requires special equipment; a malleable needle, a long, small-bore rubber tube and a slotted mattress are essential. Except for the malleable needle the other items can be readily improvised. In this series of cases the standard, fractional spinal rubber tubing has been available; however a Levin tube or urethral catheter could have been substituted. A regular mattress was remodeled to fit the operating table and to contain an opening 4 inches wide extending two-thirds across the middle section.

Any patient in whom a conventional, or single-dose spinal anesthesia was indicated was given the fractional spinal anesthesia if it appeared preoperatively that the surgery would require more than one hour. No high abdominal surgery has been done at this hospital with the fractional spinal method.

The series of 25 cases to be reported includes recurrent herniae, open reductions of the lower limbs, nephrolithotomy and appendectomies. The appendectomies were done with the fractional spinal anesthesia, not because of the time element, but rather to compare operative and postoperative anesthetic complications with known complications of other appendectomies when conventional spinal anesthesia had been used.

Procaine crystals were used. Eight cubic centimeters of physiologic saline were drawn into a 10-cc. syringe, and added to 300 mg. of the procaine crystals. The 3.8-percent solution then contained 38 mg. of procaine per 1 cc. It was found that in some patients a 3-percent solution did not give good muscular relaxation.

The position of the patient, lying on his side during the spinal puncture, was the same as for conventional spinal anesthesia except for two points: The patient's back was held as far as possible away from the anesthetist during the spinal puncture so that he was more nearly in the center of the table after being turned on his back, and it was planned that the needle would lie in the opening of the mattress after the patient was turned to the supine position.

A No. 18 intravenous needle was used to break the skin, as a malleable needle cannot be easily pushed through the skin of the lumbar area. An adapter was not needed to guide the malleable spinal

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needle if the firm No. 18 needle had first made a small hole in the skin at the puncture site. There were three points that aided in securing the needle within the spinal canal. The needle was inserted slightly farther than necessary to obtain a dripping of spinal fluid. The legs were passively straightened before the patient was turned on his back. The patient was turned passively, but at no time was the skin near the flanks or lumbar area stretched as the patient was being turned. The assistant's hands on each iliac crest obviated this possibility. However, movement of the skin and subcutaneous tissue about the lumbar area would probably bend the needle instead of dislodging it.

In these cases the rubber tubing was filled with the procaine solution and attached to the needle before the patient was turned on his back. The plunger of the syringe was withdrawn slightly to observe a free flow of spinal fluid. This was done again, after the patient was supine, before the initial injection was given.

The anesthetic level obtained depended upon the site of injection, the rate of injection, initial dosage, and the degree of Trendelenburg or reverse Trendelenburg position during and after the injection. A dependable method was found to be as follows: The site of the third lumbar interspace was chosen unless surgery was to be done at the hip level. The patient was in a 5-degree Trendelenburg position with the head and neck flexed by a full pillow during and after the initial injection. The rate of injection was fast, being 1 cc. per second. The initial dose was 1½ to 2 cc. As soon as it was found that the anesthetic level was reaching the desired height, the table was flattened. Variations of this site, dosage, and position allowed variation of the anesthetic level in different patients. It was best to keep the rate of injection constant.

The maintenance doses were injected at the same rate as the initial dose, and without dilution by aspirating spinal fluid into the syringe. Typically an initial dose of 2 cc. injected as described above would allow an anesthetic level at thoracic segments 5 to 7. Within 20 to 25 minutes, 1 to 1½ cc. would be added to keep the anesthetic level high enough to prevent pain at thoracic segments 10–11, as with a McBurney incision. The lowest dosage used for an appendectomy, lasting 1 hour, was 90 mg. The greatest dosage was 450 mg. given during a period of 2½ hours. No supplementary anesthesia was given in this case. The literature reports dosages over twice this amount.

The use of epinephrine or other pressor substance was the same as with conventional spinal anesthesia. Precautions were taken against blood pressure fall, which can occur even after so small a dose as 2 cc., or 65 mg. of procaine. The procaine solution ascended the spinal canal relatively quickly when the 5-degree Trendelenburg position was used.

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Fractional spinal anesthesia has the following disadvantages: The method is relatively cumbersome; the malleable needle makes the spinal puncture somewhat more difficult; and bloody taps are more frequent. The latter occurred in one case because the malleable needle was inserted unnecessarily far to insure good position of the needle prior to turning a heavy patient. It was later found that the anesthetist and assistant could turn any patient, unassisted, and guide the tubing and needle into the opening of the mattress without difficulty.

It occasionally happens that spinal fluid cannot be aspirated after the patient has been turned on his back. Turning the needle 90 degrees often corrects the difficulty. If aspiration cannot be done, an injection can still be made, for the needle is very likely still within the spinal canal. Subarachnoid fibers within the spinal canal may cover the bevel of the needle. However it was thought preferable to keep the bevel of the needle cephalad, as it was felt that more consistent anesthetic levels were obtained in this manner.

It would be somewhat difficult to control the saline-procaine solution when high fractional spinal anesthesia is required. Dextrose 10-percent and procaine solution was used on a few conventional spinal anesthesias but was not found to be as safe as dextrose 10-percent and pontocaine solution. Therefore dextrose-procaine solution was not used with the fractional spinal anesthesias in this series, and the problem of safe, high, fractional anesthesia using procaine must be considered.

There are important advantages of fractional spinal anesthesia to the patient and the surgeon. Admittedly it is often an advantage for those concerned if more than one anesthetic agent can be used during a single operation. Pentothal is an excellent supplement to a conventional spinal anesthesia at the close of an hour-long abdominal procedure. However pentothal or any other general anesthetic agent involves an unnecessary risk if a fractional spinal anesthetic, requiring no general supplement, could have been given originally. In supplementing one patient's spinal anesthesia there is as much risk involved as when a different patient is given the single supplementing agent in a surgical procedure for which the agent is indicated. In using fractional spinal anesthesia, the one agent, procaine in this hospital, is a great advantage to the patient.

An advantage of the fractional method is seen when blood pressure fall is considered. When 150 mg. of procaine, administered by the conventional method, give an anesthetic level at thoracic segment 6, there is frequently blood pressure fall, pallor, nausea and vomiting. However, 75 mg. administered by the fractional spinal method as outlined above, may give a higher anesthetic level at possibly thoracic segment 4–5, yet blood pressure fall and associated signs are in-

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frequent. In addition one notes that nausea and vomiting may occur after a 150-mg. dose of a conventional spinal injection, although the systolic blood pressure is 100 mm. or above. Vomiting with fractional spinal anesthesia in this series of cases did not occur when the blood pressure was above a systolic pressure of 100 mm. This finding would substantiate the impression that small multiple dosages of procaine intraspinally are less toxic than one single dose of the same quantity.

Large series of cases have proved in other hospitals that fractional spinal anesthesia with procaine added no postoperative complication not already seen when a conventional spinal anesthetic was used.

In summary, the malleable spinal needle is necessary for fractional spinal anesthesia. A rubber tubing and mattress can be improvised successfully. An outline of one method for administration of continuous spinal anesthesia has been given. The disadvantages and advantages have been discussed.

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CURARE DURING ANESTHESIA

Experiences with curare during inhalation anesthesia and laboratory investigations of its properties give the impression that curare is a safe drug, and that it is proving to be a valuable adjunct to the anesthetist's armamentarium. Its ability to provide complete muscular relaxation and contract the intestine assists materially in improving the working conditions of the surgeon without significantly increasing the immediate or ultimate hazard to the patient. Its principal disadvantage is the narrow margin between the effective dose and the dose which produces respiratory depression. With proper control of respiration, this disadvantage proves, however, to be minimal. Complete and unqualified recommendation of the drug is withheld pending further clinical and laboratory investigation. It should not be used by the inexperienced and unskilled anesthetist to secure relaxation which is otherwise unobtainable because of inadequate anesthesia. Curare can be used successfully and safely only in conjunction with properly conducted inhalation anesthesia.—CULLEN, S. C.: Clinical and laboratory observations on use of curare during inhalation anesthesia. Anesthesiology 5: 166–173, March 1944.

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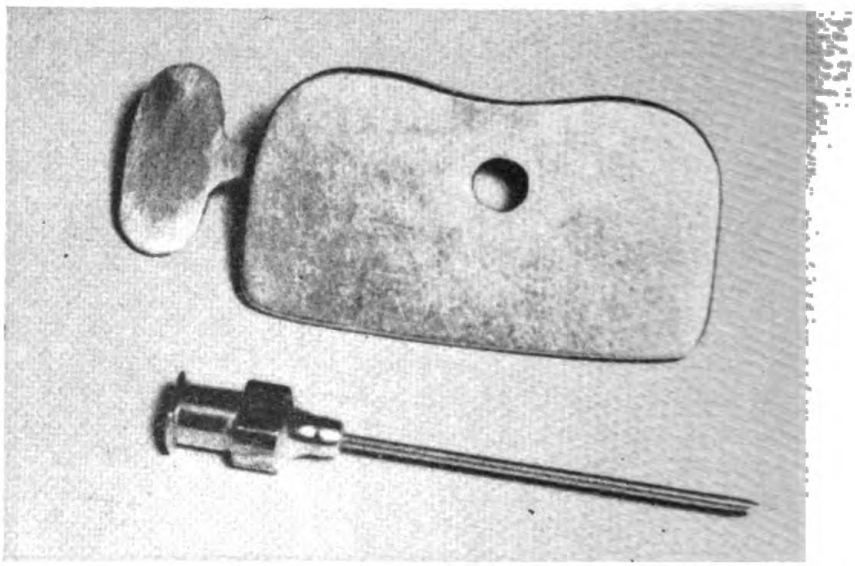
VENIPUNCTURE

A TECHNIC AND A NEEDLE HOLDER FOR ITS FACILITATION

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Venipuncture is one of the most common procedures used in the diagnosis of disease and the treatment of patients. The performance of venipuncture requires considerably more skill and technic than is usually appreciated.

The insertion of a needle into the large vein of a healthy and robust individual is an easy task, whereas in children, the obese, the debilitated, those who have previously had many venipunctures, and patients in shock, it can be extremely difficult.



1. Anterior view of the needle holder. The intravenous needle is included for comparison of size.

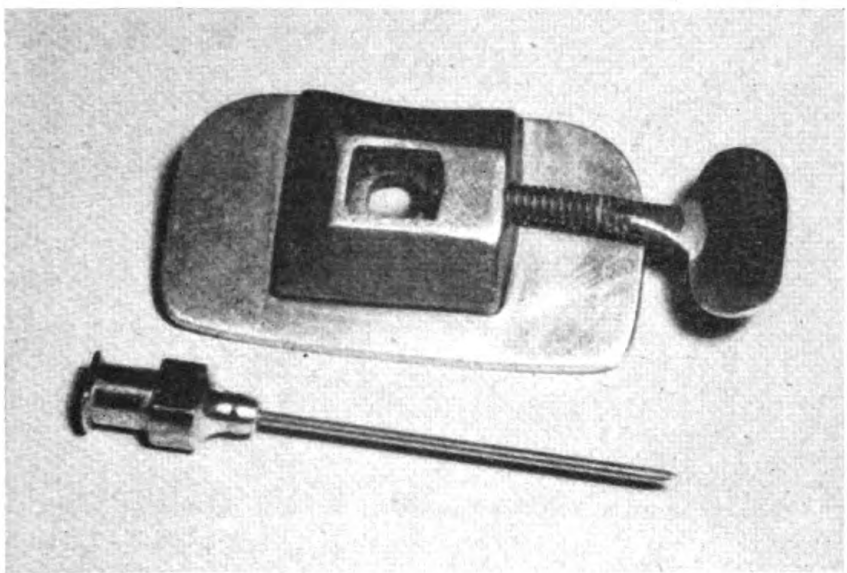
Many methods of venipuncture have been described and an infinite number are in use. The unattached or open needle technic has been found to have most gratifying results and is worthy of more general appreciation. Venipuncture by this method has several highly desirable features. The needle which is to be inserted into a vein is not attached to a syringe, a rubber tube or a glass adapter. The flow of blood from the needle gives evidence that the needle is properly inserted in the vein. The possibility of puncturing the opposite wall of the vein is minimized and there is no syringe to

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hinder the direct attachment of the intravenous set. The objection to the spilling of a few drops of blood is offset by the knowledge of successful venipuncture. Moreover the proper placing of a sponge will avoid any unsightly soiling. An open needle has a definite advantage over a recently publicized "vein seeker" and will permit easy flow of blood from a collapsed vein of a patient in shock.

Although venipuncture can be satisfactorily and advantageously performed with the base of the needle grasped with the index finger and the thumb, a handle or needle holder is highly desirable. A hemostat fulfills this purpose most satisfactorily. The Lewisohn needle is ideal but it has the disadvantage of being expensive and frequently is not available. To overcome these difficulties a detachable needle holder was devised which when applied to any standard needle, makes in effect a Lewisohn needle (fig. 1). This holder fits the needles which are supplied with the regulation blood plasma units.

Occasionally attempts to administer plasma to patients in shock, with a needle attached to the intravenous tubing and then inserted



2. Posterior view of the needle holder, showing how the needle is securely fixed in the holder.

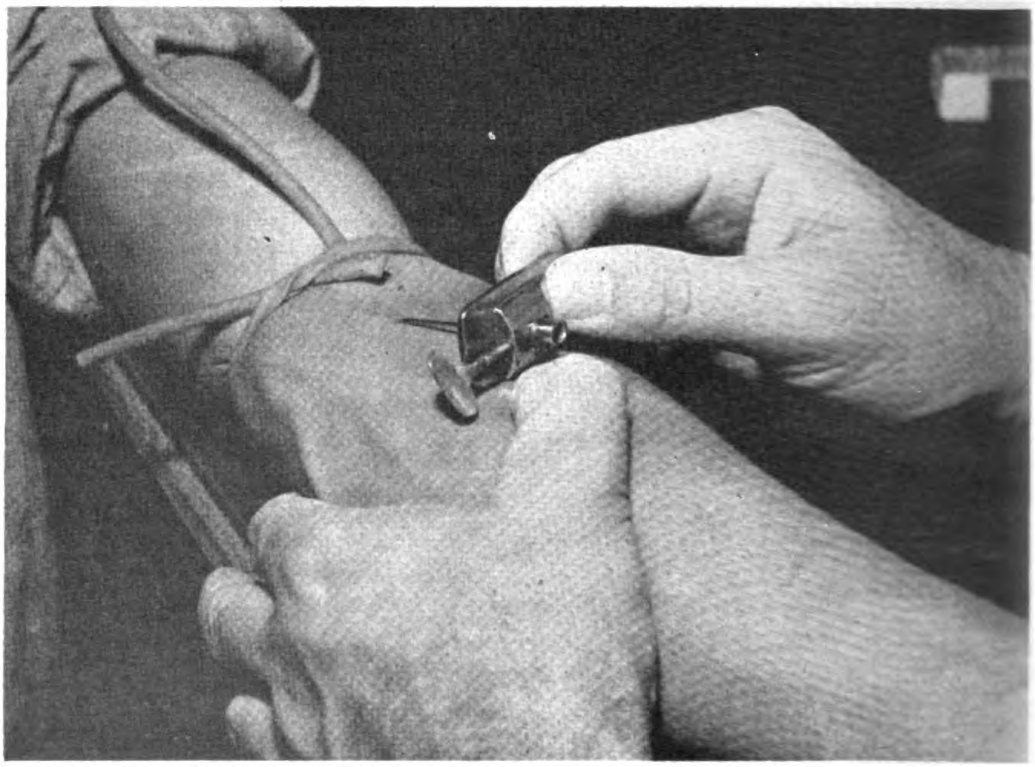
into a vein, have proved unsuccessful. The better superficial veins easily become damaged and the administration of the plasma and blood is made more difficult. It has been found that the use of the open unattached needle materially helps this situation. It is highly desirable that all veins be conserved for further therapy.

The basilic and cephalic veins in the antecubital fossa are most commonly chosen for venipuncture and the administration of intravenous fluids. It should be remembered that the radial and the dorsal

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metacarpal veins in the upper extremity are frequently just as accessible and occasionally more convenient. The external jugular and the femoral veins in children sometimes have to be used. In both adults and children the internal saphenous vein, between the internal malleolus and the tendon of the extensor hallucis longus is most accessible. It is superficial, constant, of fair size, usually does not encroach upon the field of operation, and a needle in it can be well immobilized. In the majority of patients in whom venipuncture offers a problem the location of a vein is more easily determined by palpation than by vision.

The following procedure is recommended for aid in successful venipuncture. The vein is selected and the tourniquet applied near the



3. The performance of venipuncture preparatory to the administration of intravenous fluid, plasma, or blood. When the vein is entered blood appears through the needle. The tourniquet is quickly released with the left hand and the intravenous tubing attached to the needle.

proposed site of puncture, tight enough to occlude the vein but not the artery. The part of the extremity distal to the tourniquet is rubbed toward the tourniquet. The vein is gently palpated, its course determined, the site of puncture selected and this area cleansed with alcohol. The thumb of the left hand fixes the skin over the vein and at the same time puts the vein "on the stretch." The needle, usually gage No. 18 or No. 20, is grasped by its holder with the right hand, is held firmly

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and slowly inserted into the skin. The needle is under control at all times, and there is no abrupt plunge as it penetrates the skin. When the vein is entered, blood immediately appears through the needle. The grasp on the needle holder is not relaxed while the left hand releases the tourniquet and attaches the previously filled tubing of the intravenous set to the needle. With adhesive tape the needle holder-needle combination is fixed in position and the procedure is completed.

In those patients whose veins are not easily accessible because of obesity, debility, frequent venipunctures, or age, and those whose needs for intravenous therapy do not constitute an emergency, obscure veins may be made prominent by the proper use of hot packs. The packs must be massive, must entirely encase the extremity, including the foot or hand, and extend to the axilla or to the groin. It is sometimes amazing how many veins can be rendered accessible by 30-minute to 2-hour application of hot packs.

It should be emphasized that in the gravest emergencies, when it is essential to perform venipuncture and administer intravenous fluids at once, coolness must be maintained, and the procedure carefully thought out and deliberately executed. It is futile to make frequent unwise punctures with the hope that one will find a vein. There is no substitute for a sound technic.

TOXIC ACTIONS OF DEMEROL

Few serious toxic actions of Demerol have been reported. It does not depress respiration except in hypersensitive patients, nor does it affect blood pressure, basal metabolic rate or the blood sugar level. It has no demonstrable deleterious effect on the blood. Like atropine it causes dryness of the mouth and flushing. Occasionally, excessive perspiration follows its use. The most common side reaction is dizziness. Now and then it may evoke vomiting and nausea.

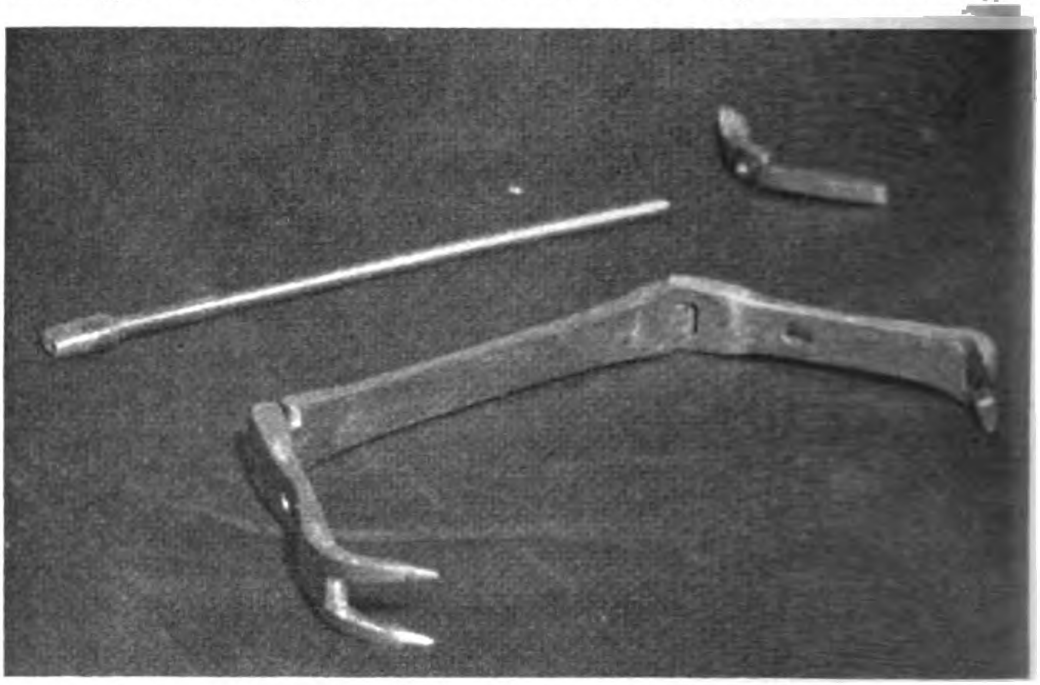
Tolerance to the drug is developed, but is not comparable to morphine tolerance. From the reports of various investigations, it appears that tolerance is not a serious obstacle to its use. Habituation may occur, but unlike morphine addiction, physical dependence does not develop except occasionally in former morphine addicts. Euphoria is experienced by some patients, but the psychologic action is unpredictable and may even be unpleasant.—QUICK, A. J., and TATUM, A. L.: Comments on treatment. Wisconsin M. J. 43: 326, March 1944.

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DEVICE FOR USE IN TRANSVERSE FRACTURES OF THE PATELLA

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Fractures of the patella have become much more frequent during the past decade owing to the increased number of highway accidents. Practically all fractures of the patella require some type of open operation either for repair or removal of the injured bone. However a discussion of the various technics of repair is beyond the scope of this paper. A gadget that can be used with advantage for the fixation of the fragments in simple transverse fractures of the patella is described.



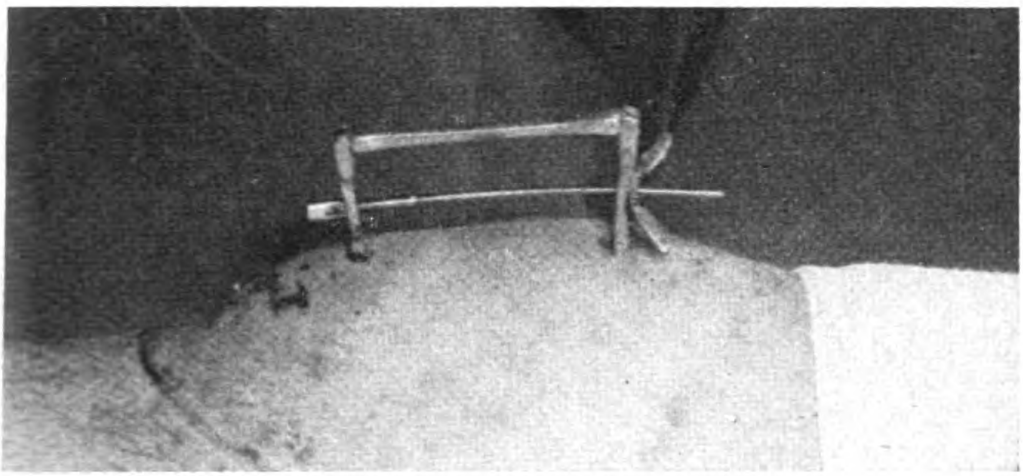
1. See description in text.

The device consists of a supporting horizontal bar; two pieces with curved double-tooth guarded points attached to the ends of the horizontal bar by means of a hinged joint; one threaded pin with set screw to hold the pointed end-pieces in the patella and bring the fragments into apposition. The instrument is shown in figure 1. It is made of stainless steel, is very strong, and does not corrode in the tissues.

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The horizontal bar is 2½ inches in length, ⅛ inch thick, and ¼ inch wide, narrowed somewhat toward the center for lightness. The vertical bars with the points are 1½ inches in length, of the same thickness and width as the horizontal bar, with the tips having 2 points ¼ inch apart and curved inward so as to permit easy insertion into the patella fragments.

The threaded pin is 3¼ inches in length with a set screw to fit. The hole in each vertical bar is ½ inch below the horizontal bar and 1½ inches above the tip of the points. Figure 1 shows the pin and set screw removed.



2. Showing instrument in use.

Figure 2 shows the instrument in use on a fractured patella after having had an operation performed for repair of torn ligaments and approximation of the patella fragments. After the incision was healed (about 7 days) the patient was able to flex the knee to about 15° without any particular pain and was therefore able to stand a great deal of passive motion, shortening the time for his recovery. The device was retained in place for 6 weeks and removed without anesthetic. He was up on crutches during the last 4 weeks of convalescence.

My thanks are extended to Lieutenant, junior grade, F. H. Van Bergen (MC) U. S. N. R., and to Warrant Officer W. F. Thompson for their assistance and cooperation in the devising and construction of this instrument.

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SIMPLE METHOD OF CONVERTING STOKES STRETCHER-TYPE JEEP AMBULANCE INTO A FIELD LITTER-TYPE AMBULANCE

STANLEY P. WALLIN
Commander (MC) U. S. N. R.

The jeep ambulance known on the Marine Corps Table of Basic Allowances as a one-quarter-ton 4 by 4 is constructed to accommodate the Stokes stretcher and is designed for use by the medical detachments of the Marine Corps. It is to be used as an accessory means of transporting wounded over difficult terrain and in situations prohibitive to the use of the larger type ambulance, more especially between combat areas and collection stations.

For this mission the present jeep ambulance serves its purpose well, but it has one great disadvantage. The field litter with which medical detachments in the Marine Corps are equipped cannot be used in the jeep ambulance.

The field litter is standard equipment in the Marine Corps and is the only type of litter allowed on the Tables of Organization. In the interests of equipment uniformity and practical application, it is inadvisable to have more than one type litter. The field litter is the litter of choice for field work because it is light, it can be compactly stored, patients can readily be treated on this litter, it can be carried easily, and it can even be used as an operating table under combat conditions. All of these features are lacking in the Stokes stretcher for field use.

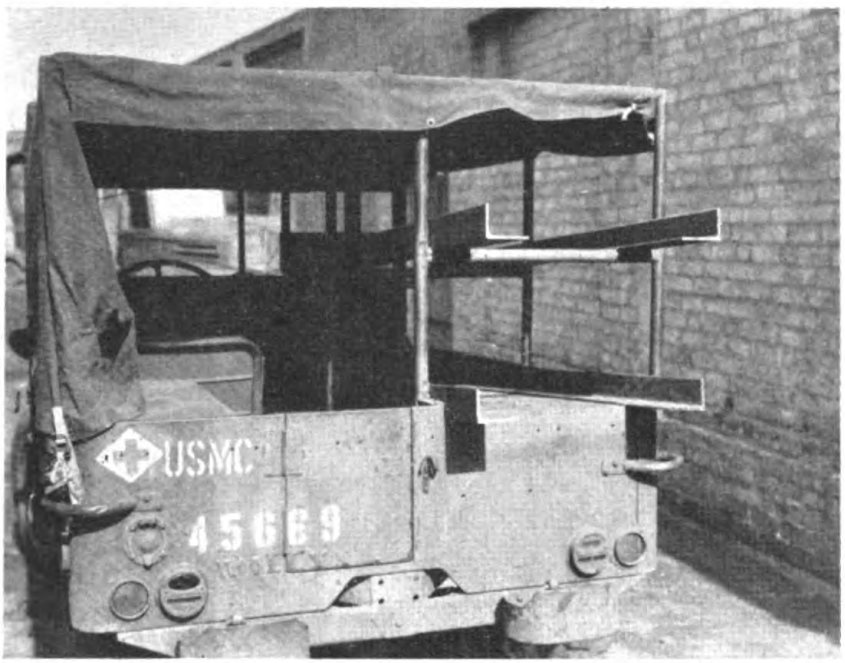
As the field litter cannot be used in the present type jeep ambulance, and as the medical detachments are already equipped with field litters, the following simple method of converting the ambulance to accommodate field litters as well as Stokes stretchers was devised.

The conversion requires no drastic changes in construction in the body of the jeep or in the ambulance frame. The time consumed in making the change is 2 hours or less and the actual conversion can be effected by the repair section of the Marine Motor Transport Company.

The principle of this change is the addition of a single-angle iron track secured on the inside of each litter bay. This track affords a slide and a support for the 4 supporting stirrups which are attached to the underside of the field litter. The angle iron used is 4 by 3 inches, of $\frac{3}{8}$-inch stock. The 4-inch surface forms the track and the 3-inch surface forms the upright guide on the outside of the track (fig. 1).

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The length of each upper litter bay is 75 inches. In the lower litter bay the port track is 76½ inches long, the starboard is 70 inches long. The wooden decks of the litter bays can be left undisturbed by the addition of the angle iron tracks.



1. View of rear of converted ambulance.



2. Side view of converted jeep loaded.

The tracks of the upper litter bay extend from the horizontal crossbar immediately behind the windshield of the jeep, rest on the center crossbar of the ambulance frame, and extend 8 inches beyond the after crossbar of the ambulance frame. They are secured to these

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crossbars by spot welding or by bolting, one weld or one 3/8-inch bolt to each horizontal crossbar.

The track on the port side of the lower litter bay extends aft from the jeep instrument board to a point 8 inches beyond the body of the jeep and rests upon the body frame. It is secured by spot welding or bolting at the following points: The forward end of the track to the lower end of the forward center vertical stanchion; the center of the track to the middle vertical stanchion; and the after end to the body frame (figs. 1, 2, and 3). Where the after end of the track rests on the jeep body frame, it was necessary to remove a 1-inch by 1½-inch triangular piece from the body frame to accommodate the angle iron track.



3. View of rear of converted ambulance loaded.

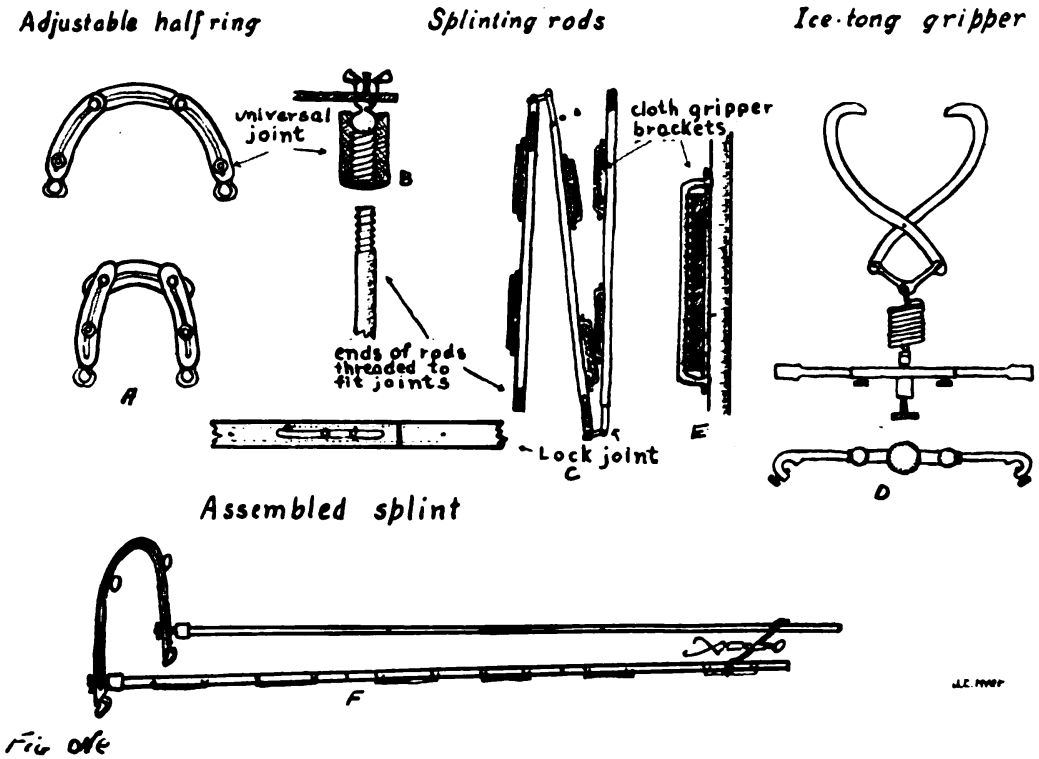
The starboard track of the lower litter bay cannot be extended from the instrument board as can the port track, because of the narrowing of the jeep frame. Therefore the track starts at a point 6½ inches from the instrument board and extends aft along the flange of the jeep frame. It is secured along this flange by spot welding or by bolting. The after end of this track rests on the edge of the jeep frame (fig. 3). At this location it was necessary to remove a small rectangular piece from the body frame to accommodate the angle iron track. It will be noted that only at these two points along the tracks of the lower litter bay was it necessary to remove any piece from the body of the jeep and these are unessential in the construction of the jeep.

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MULTIPLE-PURPOSE EMERGENCY SPLINT

GEORGE A. MOOSEY
Lieutenant (MC) U. S. N. R.
and
JOHN C. MYER
Lieutenant (MC) U. S. N.

The wartime transportation of wounded from the scene of injury presents many difficulties, those with skeletal injuries greatly increasing the problem. Our present types of splinting apparatus are in general too bulky, too large to carry, and have individually too limited a use. As a result of these limitations many patients are returned to the aid station or hospital without splinting of the injured part, or if an improvised splint is applied, it is usually inadequate and ineffective.

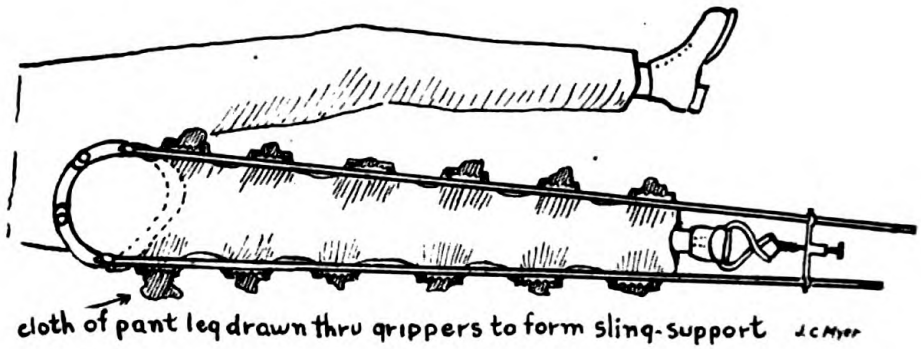


1. Details of assembly.

The multiple-purpose splint has the following features to recommend it: (1) Compactness; it is only 20 inches long when folded for carrying; (2) lightness; it weighs only a trifle over 2 pounds; (3) inexpensiveness; it is easy to produce; and (4) simplicity; it is easy to apply as it has only two parts to fit together and utilizes the patient's clothing for additional support.

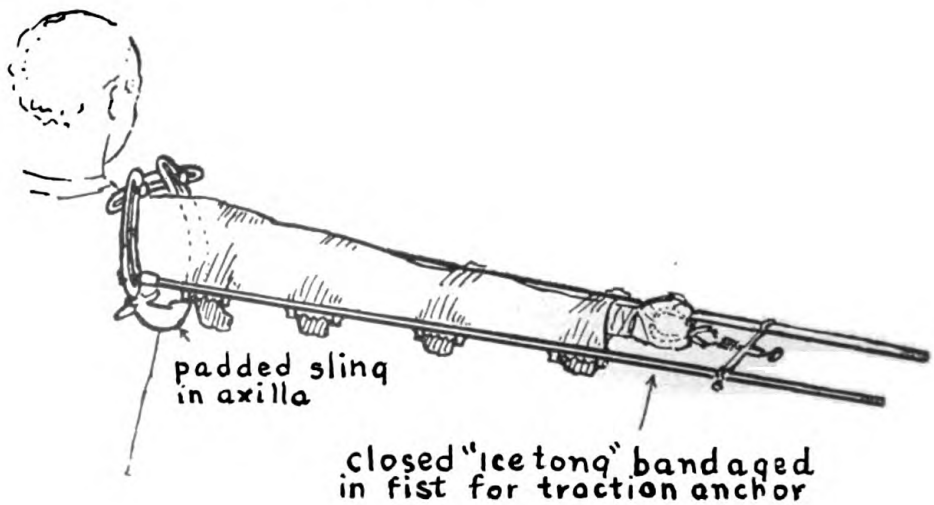
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For leg injuries the splint has many advantages. It is applied with a minimum of movement to the injured leg, the half-ring being fitted on the opposite leg and then applied to the injured side. Traction is obtained by the ice-tong spring arrangement with the shoe. Constant tension is applied and held firmly (fig. 1 D). The patient's dungarees are utilized for the cradle of the injured leg by means of the loops and the lock attachment on the rods (fig. 1 E). The straps which are attached to the rods may also be used in the loop-lock arrangement if desired. The splint is easily applied and tension on the leg is constant and may be tightened or loosened by a simple turn of the turnbuckle.



2. Use on leg.

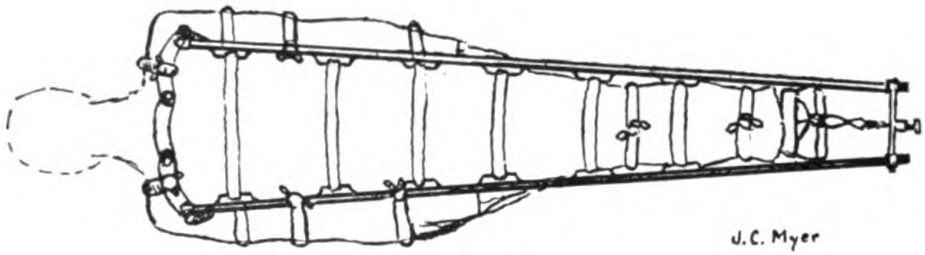
The splint may be used on the arm by having the strap arrangement with padding in the axilla and the hand bandaged around the turnbuckle. Traction may be applied in the same manner as for the leg if desired. The jumper sleeve may be used as an arm cradle in the same manner as the dungarees (fig. 3).



3. Use on arm.

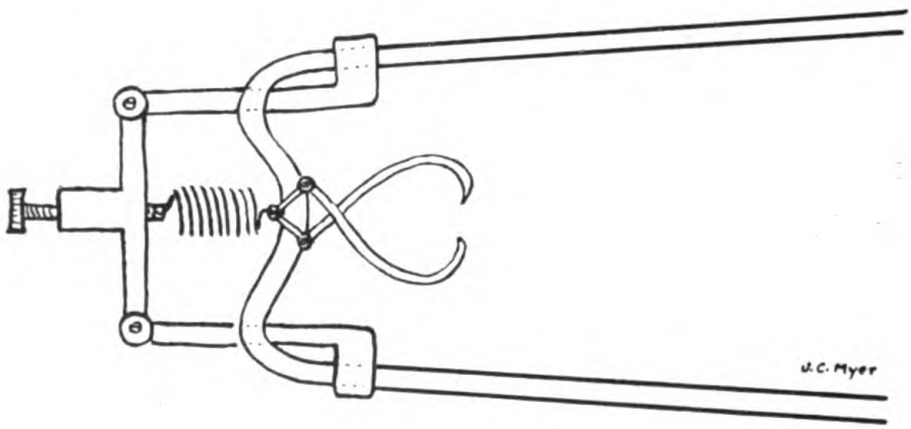
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The handling of back injuries in the field presents many and varied problems. The splint can be applied very effectively, and transportation of the wounded man is made much easier (fig. 4). Traction if desired is applied by addition of an extra length of rod. If two corpsmen are present the use of a second splint will convert the apparatus into a temporary litter.



4. Use in back injuries.

The greatest usefulness of the apparatus is in the field at the scene of the injury. It is simple, easily applied, and its multiple uses eliminate the necessity of any other type of splinting arrangements. The turnbuckle spring ice-tong gripper can be applied to other types of splinting devices such as the Thomas splint (fig. 5).



5. Adapted to Thomas splint.

The splint is not intended as a therapeutic apparatus but one which may be used to maximum advantage in the emergency immobilization and transportation of all types of fractures. It was used in lumber camps by the authors prior to their entry into the service. The use of the apparatus in civil life has proved very effective.

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EDITORIALS

SHALL BASSINI DIE?

A frank presentation of the hernial problem in the British armed forces is discussed editorially in a current *Lancet* under the caption Shall Bassini Die?[1] Directed specifically at end-results, it is contended that the appalling rate of postoperative recurrences belies the soundness of the principles behind the type of surgical repair.

The evidence that the operations were performed throughout Great Britain and Ireland on service men prior to their enlistment, gives a cross section of British surgery.

Placing the blame for this unsavory situation squarely upon faulty technic, a demand is voiced that surgeons accept the fact that herniorrhaphy is a difficult operation, one that calls for all the skill, knowledge and patience at a surgeon's command.

The editorial rightfully castigates the surgeon who takes care of gastrectomies and leaves the hernias to take care of themselves.

It denounces the type of operation as inadequate, calling attention to the fact that the Bassini repair or one of its modifications was routinely used.

A hernial operation is a plastic operation of the highest order, demanding not merely an appreciation of simple esthetic approximation of tissues but a thorough knowledge of the architectural mechanics involved. It is not surprising that failure should follow a procedure that is founded on unsound anatomic and physiologic principles.

The blame however lies not entirely on the surgeon. Rather the responsibility rests more on a surgical teaching which fails to take cognizance of the primary factor operating in the production of a hernia.[2] The importance of the transversalis fascia in this respect can scarcely be exaggerated. Considering a hernia as a protrusion of a viscus through any part of the abdominal parietes it is evident that the first layer immediately adjacent to the peritoneum must be defective or penetrated before the abdominal contents can escape. It is therefore to this layer that resort must be made for an answer to the question of the cause and repair of a hernia. A strong, resisting

[1] Editorial. Shall Bassini die? Lancet 1: 55, January 8, 1944.

[2] ZIEMAN, S. A.: Importance and distribution of transversalis fascia from viewpoint of surgeon. Arch. Surg. 45: 926–934, December 1942.

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transversalis fascia is incompatible with a hernia. No other structure can replace it. Destroy its continuity, relax its aponeurotic plan, and potential pathosis is apparent. On the other hand reconstruction or repair of this fascia constitutes the essential step in any herniorrhaphy.

How such an important structure escapes the emphasis it deserves is inexplicable. Yet a recent anatomic atlas [3] is conspicuous in omitting even a single reference to the transversalis fascia.

Furthermore it has been pointed out that an intact falx inguinalis aponeurotica or the so-called conjoined tendon is present in less than 20 percent of individuals.[4] Any operation therefore founded upon such an inconstant structure as the conjoined tendon is doomed from the start to failure proportionate to the presence or absence of that structure. Add to this the personal error of the surgeon's failure to recognize the structures before him and the lack of appreciation of the etiologic factor productive of a hernia, and the appallingly high ratio of recurrence is easily understood.

In the light of these incriminations the question is not Shall Bassini Die? but rather Is Surgical Teaching Adequate?

MALARIAL IMMUNIZATION

The cyclic character of malaria seems to preclude any effective degree of immunity. Factors operating during the disease definitely make the antigen-antibody reactions in malaria appear inconsequential. However each attack of malaria must contribute some relative degree of protection, as subsequent attacks are usually less violent.

Many natives inhabiting malarial areas are shown to harbor tremendous numbers of parasites and yet exhibit no clinical manifestations. Even in our armed forces at this comparatively early date there have been reported many cases with parasitemia without clinical evidence of the disease. These individuals evidently are successfully handling their infection. But it appears that some patients are notoriously lacking in ability to acquire any adequate degree of immunity. Moreover the frankly relapsing nature of malaria definitely demonstrates the ability of the parasite to override periodically any amount of protection that the host may be able to elaborate.

Perhaps it is this observation that makes attempts to prepare a vaccine rather discouraging. That antigens are developed, however, is

[3] GRANT, J. C. B.: An Atlas of Anatomy, vols. I and II. Williams & Wilkins Co., Baltimore, 1943.

[4] ZIEMAN, S. A.: Fallacy of conjoined tendon; etiology and repair of inguinal hernia. Am. J. Surg. 50: 17–21, October 1940.

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proved by a number of tests based on precipitin and complement-fixation reactions [1, 2].

Recently Jacobs [3] has given an encouraging ray of hope that effective immunization against malaria may not be too far in the distant future. Using ducklings for experimental subjects he was able to show that the subcutaneous injection of a saline-insoluble residue mixed with a staphylococcus toxoid gave practically 100 percent immunity.

The experiments demonstrated conclusively that plasmodial substance insoluble in saline solution contained effective antigenic material; furthermore that its effectiveness could be sufficiently increased to give promise of a wider application by the additions of a bacterial toxin.

The rationale of the addition of the toxoid is interesting. It has been shown [4, 5] that this substance when combined with a nonantigenic material served to make it antigenic. When the saline-insoluble precipitate provoked only a minimal degree of protection, 50 percent of the red cells showed parasites. Hence it was decided to examine the response after the addition of staphylococcus toxoid.

Jacobs does not claim that his material, an extract of protamine plasmodial precipitate insoluble in saline solution, produces immunity, but rather it offers an effective protection against malaria. However he feels that the way has been cleared for the elaboration of a good vaccine, one that will provoke an immunity so powerful that overwhelming doses of living parasites will be neutralized without delay.

PHYSICS IN MEDICINE

The rehabilitation program has placed added responsibility upon the profession and projected physical medicine into a role of prominence. There was a time when a multiplicity of physical devices in a doctor's office smacked of quackery. Aloofness and scepticism consequently developed toward acceptance of such modes of therapy. However the contributions of modern physics are not to be gainsaid.

The principles of Force and Movement have long found daily application in the routine work of the orthopedist. Traction and counter-

[1] TALIAFERRO, W. H., and TALIAFERRO, L. G.: Precipitin test in malaria. J. Prev. Med. 2: 147–167, March 1928.

[2] STRATMAN-THOMAS, W. K., and DULANEY, A. D.: Complement fixation in human malaria; diagnostic application. J. Immunol. 39: 257–264, September 1940.

[3] JACOBS, H. R.: Immunization against malaria; increased protection by vaccination of ducklings with saline-insoluble residues of Plasmodium lophurae mixed with bacterial toxin. Am. J. Trop. Med. 23: 597–606, November 1943.

[4] SCHWENTKER, F. F., and COMPLOIER, F. C.: Production of kidney antibodies by injection of homologous kidney plus bacterial toxins. J. Exper. Med. 70: 223–230, September 1939.

[5] BURKY, E. L.: Production in rabbit of hypersensitive reactions to lens, rabbit muscle and low ragweed extracts by action of staphylococcus toxin. J. Allergy 5: 466–475, July 1934.

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traction involve the fracture bed in a maze of pulleys, levers, and weights, and the more skillfully these principles are applied the more certain the physiologic end-results.

With the acceptance of physical devices, added responsibility is placed on their user to eliminate the possibility of abuse. It is necessary to know the dangers as well as the advantages of their application. It should be remembered that the human body is not a simple mechanical thing; that the laws of physics, however applicable, are applied to a viable mechanism that has considerable potentialities of self regulation for its own preservation, and hence may vitiate any expected good from these sources. Moreover it should be realized that the results of application may not remain entirely local but may exert a generalized response not only offsetting the intended local good but decidedly contraindicating its use. Such examples as applying heat to a limb in which the circulation is so defective that it cannot respond to the demands made on it, and the application of heat in cases of shock, are instances in question. In the one, gangrene is precipitated, while in the other with circulating blood inadequate, increased vasodilatation and metabolism will result in a further lowering of the blood pressure, exposing the unhappy individual to a fatal outcome. Recently similar examples have been discussed in the pages of this BULLETIN.[1, 2]

But it is in the division of radiation that physics has contributed most to medicine. Studies in x-rays, gamma rays and ultraviolet rays have brought about innumerable therapeutic applications of these agents.

Visualization of the blood vascular system by means of sodium fluorescein and ultraviolet radiation has found practical application in ascertaining the viability and circulation of pedicle flap grafts, whereas ultraviolet radiation alone of granulating areas appears to have a beneficial effect upon subsequent skin graft takes.[3]

Nuclear physics and the cyclotron, parenteral radioactive phosphorus and other radioactive substances have introduced many possibilities in the field of therapeutic medicine.

Someone has referred to this war as a physicist's war. Certainly physics occupies a place similar to that enjoyed by chemistry in the last war, and there is every reason to expect it to hold a postwar popularity comparable to its sister science. Hence with this tremendous stimulus to research, medicine can only benefit by the contributions of applied physics in the future.

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[1] PERISHO, G. M.: Fever therapy in chemoresistant gonococcus infections; an analysis of 150 consecutive cases. U. S. Nav. M. Bull. 42: 971–976, April 1944.

[2] TURVILLE, W. H. H., and FETTER, F.: Experiences with fever therapy at Philadelphia Naval Hospital. U. S. Nav. M. Bull. 41: 431–441, March 1943.

[3] STRAATSMA, C. R.: In press.

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BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

PSYCHOSOMATIC DIAGNOSIS, by *Flanders Dunbar, M. D., Med. Sc. D., Ph. D., Departments of Medicine and Psychiatry, Columbia University;* with a foreword by *Leonard G. Rowntree, Colonel, Medical Reserve Corps, United States Army.* 741 pages. Paul B. Hoeber, Inc., New York, publishers, 1943. Price $7.50.

This excellent volume by Flanders Dunbar, a capable pioneer in the field of psychosomatic medicine, is a "textbook in embryo" in a scientific discipline which is itself embryonic. The book is quiet and composed and replete with facts and figures. There are no extravagant claims; the situation is merely set forth as it is seen and the reader has new fields opened to him.

At the outset, we are told that in 1980 three-quarters of the population will be over 20 years of age. A National Health Survey shows that nearly one-half of our sufferers from chronic disease are under 45 years of age, and 70 percent are under 55. Dublin predicts that the total volume of illness will increase in the next few decades. This is partly because the major causes of death and disability are no longer illnesses etiologically understood, and partly because the increasing age of the population increases the frequency of these baffling illnesses. The author notes that, "The illnesses with which the physician is least well prepared to cope are the illnesses he will meet with greatest frequency in his practice." In view of the data presented, she then asks the question, "Are basic concepts, methodology and techniques of an entirely different type demanded?" With this, the author begins, as do all good clinicians, by an examination of the medical history.

The first chapter deals with the tremendous importance of history-taking and shows how the psychosomatic history complements both the medical and psychiatric ones. The therapeutic importance of his-

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tory-taking is demonstrated. One striking example of the value of a change in focus in history-taking is evidenced by the spectacular case of a woman who has been a gastro-intestinal and cardiovascular invalid for 20 years and who was made and remained symptom-free for 8 years after 10 psychotherapeutic periods (page 107 et seq.).

Chapter 3 gives a statistical analysis of general hospital admissions with some interesting conclusions. It indicates that various disease groups differ from each other in ways that can be determined objectively. The differences seem to be independent of age and sex distribution and serve to remind us that we are not dealing with clinical rarities, but with ordinary, everyday, garden varieties of patients.

The chapter on fractures brings out some interesting statistics. Seventy-four persons out of every 1,000 are injured every year. In a sample representation of the urban population, it was found that permanent impairment due to falls alone has a rate per thousand six times the impairment resulting from wounds of war. Statistics dealing with industrial accidents show a very large proportion of accidents are suffered by a very small percentage of employees. In other words, there are persons who are accident-prone, and the author's studies indicate that they can be spotted even more easily than can a person with tuberculosis or cardiac disease.

Three and one-half percent of the total population suffers from high blood pressure and arteriosclerosis. Every alternate individual in the United States over 50 years of age dies of cardiovascular disease. Cardiologists would benefit greatly by reading the chapter on hypertension and cardiovascular disease, for nervous instability was reported in the families of three-fourths of the patients examined. There seems to be a typical behavior pattern for hypertensives which is described quite aptly by the author. Persons with hypertensive cardiovascular disease have a personality profile that distinguishes them from other groups. They are predominantly introverted and strain and anxiety show in their appearance. They are shy in social relationships and ambitious but afraid of not making the grade.

It is interesting to note how the author gets together the outstanding points in the patients' personal histories. This is particularly well seen in her discussion of coronary occlusion, of which, incidentally, there are 500,000 attacks yearly in the United States.

The chapters on coronary occlusion, the anginal syndrome, rheumatic fever and rheumatoid arthritis and the cardiac arrhythmias are extremely interesting and are of greatest importance for the clinician.

The profile at the end of each chapter is a psychophysical and psychologic cross section of the patients' lives and a summary of characterologic defenses and relative successes and failures. It is interesting to note how these patients resemble one another psychologically

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and somatically. The personality pattern in the case of recurrent decompensations seems to be especially important, and these patients are helped by psychotherapy.

The conclusions regarding the sufferers from diabetes mellitus (pages 540 and 541) are noteworthy, and rather than quote it in part. I would suggest that the entire chapter be read.

Chapter 9 describes the contrasting profiles of the various diseases, while Chapter 10 concerns itself with combined and overlapping syndromes.

In the chapter on the general theory and criteria for therapy, the author modestly tries to warn the reader away from her philosophic speculations. However, her discussion of emotional thermo-dynamics is quite worth while and will well repay the inquiring reader.

A HANDBOOK OF PSYCHIATRY, by *P. M. Lichtenstein, M. D., LL. B., In charge of Psychiatry and Legal Medicine for the District Attorney, County of New York;* and *S. M. Small, B. S., M. D., Formerly Instructor in Psychiatry at the Cornell University Medical College.* 330 pages. W. W. Norton & Co., Inc., New York, publishers, 1943. Price $3.50.

For a handbook of psychiatry, this volume has many merits to recommend it—simplicity of language, unpretentiousness and comprehensiveness for general use. These are qualities often wanting in texts of a similar nature. On the whole it leans toward the side of extramural psychiatry, a healthy direction away from the excessive preoccupation of the older texts with the end products of mental disease. Similarly the caution the authors show in stating various points of view, without the dogma and bias that many writers of texts are guilty of, is commendable.

Not the least of the book's virtues is that it is practical and to the point, especially in dealing with therapeutic problems, so that those who have the initial and sometimes the main responsibility for caring for the mentally ill, from the general practitioner to the nurse, the attendant and the social worker and sometimes even the intelligent relative, could read the book with profit. For these, as well as for the medical students, it is replete with helpful hints and guidance.

The 16 chapters of the book cover briefly and simply, normal personality functioning, abnormal behavior, mental examinations, psychometric tests, intellectual deficiency, psychopathic personality, psychoneuroses, and a timely chapter on war psychoneuroses. The other items are: Psychosomatic illnesses, affect (mood) disorders, schizophrenia paranoia and paranoid reactions, delirium and allied conditions, organic brain disorders, general principles of psychiatric therapy and therapeutic aids.

An adequate and quite catholic bibliography and an index, as well as an occasional case presentation mostly from the authors' own rec-

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ords, enhance the book's value to that body of workers and students who are in working relation with the psychiatric problems in or out of mental hospitals. For the practicing psychiatrist, the book, of course, is too elementary and is not intended; but for the others it can be heartily recommended.

PHYSIOLOGY OF THE NERVOUS SYSTEM, by *John Farquhar Fulton, M.A., D. Phil., D.Sc. (Oxon), S.B., M.D. (Harv.), Sterling Professor of Physiology, Yale University, Formerly Fellow of Magdalen College, Oxford.* Second edition, revised and reset. 614 pages. Oxford University Press, New York, publishers, 1943. Price $9.

This text is a second edition of what is destined to become a neurophysiologic classic. Of all the fields of basic medical research, none has enjoyed the rapid growth which has been characteristic of neurophysiology in the past several decades. There was a pressing demand for a correlation of these contributions.

The students' and the practitioners' needs in this regard are twofold: First, for a clear, concise exposition of accepted fundamental research and, second, for a functional correlation of seemingly isolated data. Professor Fulton's text admirably fills these needs.

The bibliographic and author index of 66 pages will be a valuable aid to the student; it assembles the definitive anatomic and physiologic contributions since 1925. The synoptic historical notes which preface each chapter effectively formulate the logical background for the more modern material.

The book has not suffered by the change in the type face; the new illustrations are carefully chosen and the chapters on the autonomic nervous system and the conditioned reflex are splendid additions.

This book is illustrative of the modern trend in dynamic medical teaching, which attempts to integrate and synthesize isolated researches so that they may more clearly portray the infinite wisdom of the body as a whole.

INTERNAL MEDICINE IN GENERAL PRACTICE, by *Robert Pratt McCombs, Lieutenant, Medical Corps, United States Naval Reserve; Recently Instructor in Internal Medicine for the Statewide Postgraduate Program of the Tennessee State Medical Association.* 694 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1943. Price $7.

The author has admirably covered and integrated the important features of physiology, symptomatology, diagnosis, and treatment in medicine as generally practiced. Each subject has been brought up to the latest developments in diagnosis and treatment but at all times the practical is stressed.

The section on heart disease is exceptionally well adapted to clinical usage, and that on gastro-intestinal disorders would be well worth reviewing by either internist or surgeon who is faced with a difficult

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intra-abdominal problem. The indications for use and the pitfalls to be avoided in chemotherapy are concise and up to the minute; this part would be of value to anyone employing the sulfonamides in the treatment of infectious diseases.

While this book will not replace the standard reference texts it is deserving of a place on the desk of every busy wartime practitioner and should be invaluable to the isolated service medical officer whose library is of necessity small and hard to keep up to date. Not the least of the book's virtues is the inclusion of a number of tables on differential diagnosis and therapeutic indications.

THE DYSENTERIC DISORDERS, The Diagnosis and Treatment of Dysentery, Sprue, Colitis and Other Diarrhoeas in General Practice, by *Sir Philip Manson-Bahr, C. M. G., D. S. O., M. D., F. R. C. P., Senior Physician to the Hospital for Tropical Diseases, Royal Albert Dock and Tilbury Hospitals; Consulting Physician in Tropical Diseases to the Dreadnought Seamen's Hospital, London;* with an appendix by *W. John Muggleton, M. S. M., F. I. M. L. T., Technical Assistant.* Second edition. 629 pages; illustrated with 23 plates and 108 illustrations. The Williams & Wilkins Co., Baltimore, Md., publishers, 1943. Price $10.

The second edition of this excellent treatise on the dysenteries by Manson-Bahr, the well known English tropical disease expert, was printed in Great Britain and is very well bound, but is printed on what appears to be a rather poor grade of wartime paper.

There are excellent and complete discussions of the bacillary, protozoan and helminthic dysenteries, as well as the steatorrhoeas and the colitis disorders. Various other disorders, such as cholera, and tuberculous and luetic enteritis, are discussed in a briefer manner. The author's large experience in treating these cases is quite evident and frequent case histories are used to illustrate his points. The book is very readable, contains a full discussion of the more important diseases, with modern, complete and practical details of diagnosis and therapy, and is well illustrated, a number of the plates being in color.

Laboratory methods and complete descriptions of the various causative organisms are given in the two appendices. There is also a very good bibliography.

The book is considered by this reviewer to be a valuable volume and is highly recommended to those who deal with the dysenteries, many of which are no longer purely tropical problems, as is evidenced by the increasing frequency of their recognition in this and other temperate zone countries.

PROCTOLOGY, Oxford Medical Outline Series, by *Sylvan D. Manheim, M. D., Consulting Proctologist, Rockaway Beach Hospital, Rockaway Beach, New York.* 137 pages. Oxford University Press, New York, publishers, 1943. Price $2.

Until recently the general scope of proctology appeared to be limited to the clamp and cautery removal of hemorrhoids. With the founding of American proctological societies great strides have been

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made in the study and practice of this specialty and an impressive literature has developed. The present handbook covers in outline form the essentials of proctology. Cryptitis and papillitis, anal fissures and anal ulcers, abscesses, fistula, pruritus, hemorrhoids, rectal prolapse, tumors, and venereal diseases of the rectal region are some of the diseases outlined in the 20 chapters.

The reviewer believes that a worth-while chapter on pectenosis could have been added, and that the bibliography appearing at the end of the book instead of at the end of each chapter detracts somewhat from the quick reference intent of the work. The general features and character of the Oxford series are followed in the format of this book and make easy review of the essentials of proctology.

PERIPHERAL VASCULAR DISEASES (Angiology), Oxford Medical Outline Series, by *Saul S. Samuels, A. M., M. D., Consulting Vascular Surgeon, Long Beach Hospital, Long Beach, New York.* 84 pages. Oxford University Press, New York, publishers, 1943. Price $2.

To the general practitioner, knowledge of peripheral vascular disease is limited for the most part to varicose veins and ulcers. The rapid developments, however, in this subject have spontaneously created a field of specialization, one that is assuming an ever-increasingly important role. Its scope includes surgery as well as medicine.

Hence this recent volume of the Oxford series is most timely. It follows the characteristic format of outlined subject matter, skipped sheets for note taking, and bibliography at the end of each chapter. Arteriosclerosis obliterans, thrombo-angiitis obliterans, Raynaud's disease, erythromelalgia, acrocyanosis, embolism, frost-bite (thermal gangrene), glomus tumor, and thrombophlebitis are some of the diseases outlined in this work.

As a quick reference and a stimulant for more detailed study in this specialty the volume accomplishes its purpose and is an added contribution to the already extensive series.

THE EAR, NOSE AND THROAT IN THE SERVICES, Oxford War Manuals, by *R. Scott Stevenson, M. D., F. R. C. S. Ed., Major, R. A. M. C., Otologist to a Military Hospital, Late Surgeon, Emergency Medical Service (London)*; General Editor, *The Rt. Hon. Lord Horder, G. C. V. O.* 116 pages. Oxford University Press, New York, publishers, 1943. Price $1.50.

Stevenson's contribution to the Oxford War Manuals adequately maintains the quality of this series. Only a genuine authority could condense so much in such little space, and express his thought moreover in such a delightful, unhurried style, full of sententious surprises, and apt discussions. The vigor, clarity and precision of the text is supplemented by simple excellent illustrations. Quite typically he says, "It is not accurate to call the tympanic membrane the drum; the

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whole tympanic cavity is the drum, the outer membrane is the drumhead."

The military surgeon has two great advantages over the civilian practitioner. Constant attendance on the men's medical needs makes early diagnosis likely, and patients can be put to bed without economic penalty. "It is far more important for a medical officer to put a soldier, sailor or airman to bed for 24 hours when he has a bad cold and prevent his developing an acute middle ear inflammation than to make a brilliant diagnosis of an obscure cerebellar abscess six weeks later."

The author defends the voice and whisper test. The ordinary range of conversational voice lies between 128 and 512 cycles per second; the pitch of a whisper lies between 512 and 6,000 cycles. Hence a man with nerve deafness who hears the whisper at less than one foot may still hear the conversational voice at 20 feet.

The remarks on war injuries are most interesting. Approximately 50 percent of persons injured by high explosives sustain blast injuries of the ear. Rupture of the drumhead appears to protect the labyrinth. Cotton wool moistened with vaseline or soap is a valuable protective aid.

The specialist will thoroughly enjoy this illuminating presentation, and the general practitioner who reads this volume will be properly oriented.

CLINICAL DIAGNOSIS BY LABORATORY EXAMINATIONS, by *John A. Kolmer, M. S., M. D., Dr. P. H., Sc. D., LL. D., L. H. D., F. A. C. P., Professor of Medicine in the School of Medicine and the School of Dentistry of Temple University.* 1239 pages; illustrated. D. Appleton-Century Co., Inc., New York, publishers, 1943. Price $8.

In recent years, advancement in clinical diagnosis by laboratory methods has proceeded by leaps and bounds. The physician can no longer depend on history, physical examination, and the art of medicine, but he must now support his diagnosis by laboratory findings.

Too frequently today, and especially in days gone by, the physician believed himself more or less a god who never erred in diagnosis, but this false concept developed from the fact that there was no one or no test to prove him wrong.

History and physical diagnosis are still of utmost importance. Due to the outstanding progress which has been made in laboratory diagnosis, in order to practice good modern medicine, it is necessary to take a complete history; do a thorough physical examination; then in accordance with the findings, know what laboratory procedure to order; and finally, to be able to correlate the physical with the laboratory findings. The latter two of these requirements will be greatly facilitated by the owning and proper use of this book.

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The quotation which the author makes many times in the book, namely, "no examination can be better than the laboratory or individual conducting it," is so true. Before one can put any faith in a laboratory examination, he must first know whether or not he can rely on the technician. After this, comes the matter of proper interpretation, the main purpose of this fine book.

The material is presented clearly and completely and all the new laboratory procedures and interpretations are covered.

Special emphasis is not placed on the technic of laboratory procedures, but the most important technics are outlined briefly and methods for the proper collection of materials for laboratory examinations are described in detail.

There are numerous summaries and illustrations throughout the book which will aid both the student and practitioner in study and quick reference.

INTRODUCTION TO PHYSIOLOGICAL AND PATHOLOGICAL CHEMISTRY, With Laboratory Experiments, by *L. Earle Arnow, Ph. G., B. S., Ph. D., M. B., M. D., Director of Biochemical Research, Medical-Research Division, Sharp & Dohme, Inc., Glenolden, Pa.; Professor of Chemistry, Bryn Mawr College Summer School of Nursing, Bryn Mawr, Pa., 1941–43;* with an introduction by *Katharine J. Densford, B. A., M. A., R. N., Director of the School of Nursing and Professor of Nursing, University of Minnesota, Minneapolis, Minn.* Second edition; 574 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $3.75.

This well written and well arranged book is a valuable addition to the literature of introductory chemistry for those students requiring a general basic knowledge of this subject.

Being divided into three parts, i. e., Introduction to Chemical Science, Physiological and Pathological Chemistry, and Introduction to Laboratory Chemistry, well indexed, well illustrated, facts accurately presented, and an interesting literary style, makes this an outstanding textbook for those students for whom it was intended. Having a list of questions at the end of each chapter enables the student to review and pick out those essential points covered in each assignment. The opening chapter explains why chemistry is studied, the method of approach, and the objectives to be obtained. The remaining chapters in Part 1 are devoted to the fundamental principles of chemistry.

Part 2 is particularly well arranged and brought up to date by the inclusion of chemical nature and metabolism of lipids, carbohydrates and proteins. Also the chapters on urines, hormones, and vitamins give practical application to the principles of chemistry.

Laboratory experiments contained in Part 3 cover the work previously studied in Parts 1 and 2 and sum up the course in a very excellent manner. The appendix containing a list of stain removal

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methods is so complete that it will be constantly used for reference purposes.

This new edition is a very worth-while contribution and its manner of presentation should make for improved student interest in this oftentimes difficult subject.

AN INTRODUCTION TO MEDICAL MYCOLOGY, by *George M. Lewis, M. D., Member of the American Dermatological Association, Inc., Associate Attending Physician (Dermatology), the New York Hospital;* and *Mary E. Hopper, M. S., Research Fellow in Medicine, Cornell University Medical School.* Second edition. 342 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1943. Price $6.50.

The second edition of this book, which has already been accepted as a standard treatise on this subject, is especially welcome at this time when the strenuous activities of the armed forces and the unusual climatic and hygienic conditions under which these men and women are forced to live have resulted in such a marked increase in mycotic infections and especially those involving the skin.

The original book has been completely revised with new chapters on some of the rarer diseases, such as tinea nodosa, rhinosporidiosis, and histoplasmosis. The interpretation and technic of the passive transfer test as well as many other laboratory procedures necessary for the recognition and culturing of the various species of fungi have been brought up to date. Although presented from a strictly scientific point of view, the concise and clear arrangement of the subject matter makes this branch of medicine easily understood by all. The practical side of fungus diseases has been stressed while the discussion about nomenclature and classification has been fortunately omitted for the most part. It is especially gratifying to find such a complete and up-to-date clinical and laboratory description of coccidioidomycosis, since literally hundreds of cases of primary lung involvement are being encountered in the armed forces stationed in our Southwest.

A simplified but effective treatment for dermatophytosis in enlisted men and a new keratolytic agent are presented for the first time. It is regretted that the authors mentioned the use of the camphor-phenol mixture. The reviewer agrees heartily with them that "confirmation is lacking that the combination of these drugs is both safe and effective."

This edition is illustrated profusely on excellent paper with colored plates and black and white photographs arranged not only to illustrate the disease under discussion but also to clarify differential diagnosis. The illustrations depict both the commoner and the rarer aspects of these eruptions. These illustrations cannot be praised too highly.

This book should be a "must have" on the list of all physicians.

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AN INTRODUCTION TO CLINICAL PERIMETRY, by *H. M. Traquair, M. D., F. R. C. S. Ed., Ophthalmic Surgeon, Royal Infirmary, Edinburgh;* with a foreword by *Norman M. Dott, M. B., Ch. B., F. R. C. S. Ed.* Fourth edition revised and enlarged. 332 pages; 245 illustrations and 3 colored plates. Henry Kimpton, 26 Bloomsbury Way, London, W. C. 1, publishers, 1942. Price $6.50.

This excellent volume on perimetry is far more extensive in scope than the title would intimate. Its more comprehensive coverage cannot but be appreciated by neurologist and ophthalmologist.

The discussion of the normal visual fields and the evaluation of methods and instruments are highly practical.

All the principal ocular and systemic diseases as well as most intracranial lesions capable of producing visual field defects are well described and amplified by excellent illustrations.

A valuable feature is the free interpretation of the findings set forth in the descriptive and illustrated text.

The appendix includes an excellent study of pertinent anatomic relations. A complete subject and author index, along with a bibliography of 470 citations are eminently good.

ENGLISH-SPANISH, SPANISH-ENGLISH DENTAL VOCABULARY, Including Many Medical Terms, by *Joseph S. F. Marie.* 159 pages. The Jaques Cattell Press, Lancaster, Pa., publishers, 1943. Price $4.

This volume is correctly termed a dental vocabulary rather than an English-Spanish "Dental Dictionary" in that it includes no definitions of the anatomic terms or of the names of instruments, equipment, diseases, medicaments, etc. which it contains.

Physically the book is a well-printed, well-bound volume of approximately 159 pages, very nearly equally divided between English-Spanish and the Spanish-English listing.

It contains some 8,000 words and hyphenated terms which are first listed in English, with their Spanish translation or equivalent following. In the second half of the volume they are listed in reverse order. The book also contains three full-page anatomic illustrations.

It is the opinion of the writer that this vocabulary will serve a useful function, being as it is, a pioneer book of this type in the field of dentistry. It will be of use to those Spanish-speaking dental students and graduates who are attending courses of instruction in dentistry or visiting within this country and those who are preparing scientific articles for publication in professional magazines which are printed in English. It will be equally useful to English-speaking students and graduates who are within or writing for publication in Spanish-speaking countries.

Obviously it will encourage cultural relations between the United States of (North) America and the Latin American republics.

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BODY POISE, by *Walter Truslow, M. D., F. A. C. S., Consulting Orthopedic Surgeon to the following hospitals: Brooklyn, Long Island College, St. John's Norwegian, Victory Memorial, Evangelical Deaconess, Kingston Avenue, St. Giles, Brooklyn, New York and Pilgrim State, Brentwood, New York.* 312 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1943. Price $4.50.

As a nation we have not emphasized body training of our youth; the war effort brought this truth to the fore, and is effecting a change in our attitude toward physical training, particularly in the elementary school program. So postulates the author of this 312-page volume of practical suggestions for improving physical fitness through body poise.

Part 1 of the book treats of the bone, joint, and muscle relationships, presenting anatomic poise as an up-building from the soles of the feet. Part 2 deals with the restorations of lapses from good posture, and includes exercises developed by the author over a period of many years. This part is adequately illustrated with photographs and accompanying schematic sketches of the underlying anatomy. In Part 3, six leading sports and games are fully described, and twenty-one are briefly commented on with regard to development of body poise and correction of common faulty tendencies.

The book is well printed and illustrated, and contains, in addition to an index, a glossary of anatomic terms which should be helpful to the lay reader. The book is aimed, according to the publishers, at the orthopedic surgeon, the general practitioner of medicine, the physiotherapist, gymnasium instructor, masseur or nurse. It is regrettable that more emphasis was not placed on readability of the text.

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PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

FOOD POISONING AT A NAVAL TRAINING STATION

BURTIS B. BREESE
Lieutenant Commander (MC) U. S. N. R.
JOHN B. STANBURY
Lieutenant Commander (MC) U. S. N. R.
and
HARVEY C. UPHAM
Lieutenant, junior grade H-V(S) U. S. N. R.

During the 6-month period from May to October 1943, inclusive, the personnel of Epidemiology Unit 11 stationed at a Naval training station had the opportunity to observe and investigate seven small outbreaks of food poisoning. In three of these the causative organism was determined and in the last five strong statistical evidence was obtained that a particular food caused the disturbance. With increasing experience the time required to determine the cause and to apply methods of prevention was shortened.

The organization of a Naval training station, such as this one, lends itself to a study of food poisoning. The men are grouped into relatively small and compact companies which sleep, work, and eat together. This simplifies the problem of discovering common dietary and mess factors in the ill group, because those affected usually belong to one or only a few companies.

The dispensary is close at hand for interviewing the sick. The ambulatory can be interviewed either singly or in groups selected at random from pay lines or at a muster of the involved companies. The mess halls are conveniently at hand for detailed inspection and can be placed under rigorous control to prevent further outbreaks.

The epidemics of food poisoning at this station are probably representative of those occurring at other Naval activities. It is felt, therefore, that the practical methods of analysis and prevention learned here may be of value to other Naval medical units.

EPIDEMIC 1

On Tuesday, 1 June 1943, there was a small outbreak of food poisoning involving two companies in the service schools. These companies

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messed together. About 27 men became ill enough to report to the dispensary, and 7 of these were admitted for observation. All were back on duty within 48 hours. Nausea and vomiting were the prominent symptoms; diarrhea occurred in a few cases. The men began to become ill at about 0700 on Tuesday morning, and continued to do so until about 1800. A few developed symptoms somewhat later.

Unfortunately the attention of the Epidemiology Unit was not drawn to this outbreak until 2 days later. By this time it was too late to obtain samples of food which had been served, but men from the affected companies were interviewed.

The results were disappointing. A third of the ill group had been on liberty the previous day and did not eat supper at the station. This left Monday lunch and Tuesday breakfast as the meals most likely to have caused the poisoning. Tuesday's breakfast had been served approximately 1 hour before the first cases began to appear. There were no significant differences between the sick and the non-sick with respect to numbers eating and not eating respective meals. A number of men complained about the odor of the scrambled eggs served at Tuesday's breakfast. With one exception all who became ill had eaten these eggs, but almost all those who did not become ill also had eaten them. It is possible that the eggs were made up in several lots, and that one of these was allowed to stand at room temperature sufficiently long for the growth of staphylococci or salmonellae.

EPIDEMIC 2.

The first cases in the second epidemic appeared on 1 July, 1943, and cases continued to appear in appreciable numbers through 9 July. Thereafter a few appeared sporadically. There were in all 171 cases, 151 of which occurred in a single battalion undergoing training at the station's rifle range. The remaining 20 patients were from the ship's company at the rifle range.

Clinically the disease was mild. The chief symptoms were intestinal cramps and diarrhea, but neither of these was severe. The number of stools was rarely over 6 daily, and although they were frequently watery they contained no blood or pus. Mild nausea and anorexia occurred but vomiting and fever were absent. The duration of symptoms varied between 1 day and 1 week. Many of the ill did not report to sick call but were found by interviewing each man in the battalion. Every attempt was made to find all cases.

When the cases were analyzed by companies it was found that all the companies affected had been on the rifle range for periods varying from 48 to 72 hours. In one company the onset occurred before or shortly after arrival at the range. In 4 the onset occurred shortly after their return. In 2 companies the cases first appeared after the

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men had been back at the station for a period of 6 days. It seemed evident that the outbreak was related to the visit to the range, because each company made only one such trip during its period of training, and there were no other outbreaks of gastro-intestinal disease on the station at the time. The analysis by companies disclosed that the cases appeared in 3 waves during the 9-day period.

Again it was not possible to consider any single factor in this outbreak as causative. Possibly multiple factors were present. Ham had been served at 3 meals, but it could have been the cause of only the first 2 waves of the epidemic. It could not be shown that ham was eaten by a larger percentage of the ill than the non-ill. The milk and water used by the affected companies were examined for coliform organisms, but none were found. No pathogens were found in the stools of 8 patients.

From an epidemiologic standpoint it is impossible to formulate an entirely satisfactory hypothesis as to place or source of infection in this outbreak. Case-to-case spread of the disease could not be ruled out, but seemed unlikely because the disease did not spread to other battalions with which the men had come in contact. From what subsequently occurred in epidemic 3 it seemed reasonable to believe that the ham was the causative factor in at least some of the cases.

EPIDEMIC 3

On 10 July a severe outbreak of gastro-enteritis struck a battalion just as it was returning from a short stay at the rifle range. Its onset was sudden, violent, and dramatic. Sixty-four cases appeared within 6 hours, and of these, 43 patients required hospitalization. The cases were marked by severe abdominal cramps, by vomiting, diarrhea, weakness, and prostration. There was no blood or pus in the stools. Fortunately these symptoms were of short duration. Most of the patients were able to return to duty within 24 hours.

In the 6 companies in which all the cases occurred, the men had eaten only one meal in common, the noon meal at the rifle range. Two hundred men who ate this meal were interviewed. Of the articles on the menu, ham was the only one that was eaten by a higher percentage of the affected group than the group not affected. This is shown in table 1.

TABLE 1.—*Epidemic No. 3*

	Ill	Not ill	Total
Ate ham	46	130	176
No ham	0	24	24
Total	46	154	200

(Chi-square value: 8.1)

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Gastro-enteritis did not occur in those who did not eat ham. One-eighth of the ham served at this meal was from the same questionable supply as in epidemic 2; the remaining seven-eighths was a new supply. No evidence of inadequate refrigeration prior to preparation was found, but it was discovered that the hams had been sliced and allowed to stand at room temperature for 3 hours before warming and serving.

Hemolytic Staphylococcus aureus was cultivated from 2 of 5 portions of the ham. No pathogens were found in other foods served at the same meal, nor were any found in several stools and specimens of vomitus obtained from patients.

On epidemiologic and statistical grounds it seems likely that the ham was the cause of this outbreak, although the failure to cultivate pathogens from the ham in more of the samples was disappointing. The disease resembled clinically staphylococcus food poisoning. The combining of the spoiled ham with seven parts of fresh ham might account for the small number of positive cultures.

EPIDEMIC 4

On 15 July approximately 212 cases of gastro-enteritis occurred in the service schools. Diarrhea and cramps were the chief symptoms, although a few patients had some nausea and vomiting, and some had headache, chilliness, and slight fever. The number of cases was far in excess of the reports to sick call, but by personal interview and by reports from company commanders, 212 cases were located. One hundred and ninety-one of these men had eaten together.

One hundred and one members of the ill group and 98 men from the same companies who were not ill were interviewed with regard to meals and foods eaten shortly before the onset of the epidemic, and when the results were tabulated it was at once apparent that the immediately preceding supper must have been the source. This is seen in table 2.

TABLE 2.—*Epidemic No. 4*

	Ill	Not ill	Total
Ate supper	96	71	167
Did not eat	5	27	32
Total	101	98	199

(Chi-square value: 18.7)

A Chi-square test on the data of table 2 gives a value of 18.7, meaning that such a distribution could occur by chance alone less than one time in a thousand. When the data on individual foods consumed at this meal were examined, only one article, goulash, was found of significance. These data fell into a four-fold table as shown in table 3.

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TABLE 3.—*Epidemic No. 4*

	Ill	Not ill	Total
Ate goulash	98	52	150
Did not eat	3	38	41
Total	101	90	191

(Chi-square value: 42.9)

The Chi-square value on the data of table 3 is 42.9, indicating a high degree of significance. The goulash had been prepared by cooking beef, potatoes, carrots, and several other ingredients, each of which was cooked separately and then all simultaneously mixed and cooked further until placed on a steam table. Although no break in technic in the preparation of the goulash was discovered, the senior medical officer, who had inspected the galley, reported it to be below standard.

Unfortunately no food samples had been saved for bacteriologic examination, although by this time it had become a station order to do so. A few stools were cultured but nothing worth noting was found. It seems entirely clear on statistical grounds that the goulash was the source in this outbreak, but there was no bacteriologic confirmation.

EPIDEMIC 5

On the evening of 31 July, 12 men arrived on this station for special duty. Between 2200 and 2400 they were given ham sandwiches, coffee, and milk, and between 2 and 4 hours later 10 of these men became acutely ill with sweating, prostration, nausea, vomiting, diarrhea, and abdominal cramps. These symptoms were of short duration, and most of the men were on duty within 24 hours. The two men who had not eaten the sandwiches did not become ill.

The ham from which the sandwiches were made had been served at the general mess at the noon meal without ill effect, but what was left after the serving had been cooled and put into the refrigerator. It was impossible to determine how long the ham had remained at room temperature, but it was found that the refrigerator had been maintaining a temperature between 45° and 50° F. Two strains of hemolytic Staphylococcus aureus were isolated from the particular ham from which the sandwiches had been made.

The chief commissary steward, who refused to believe that ham which appeared fresh could be spoiled, ate some of the ham against advice. Within 3 hours he was violently ill with gastro-enteritis. It is important to point out that although from the outside, the cut surface, and the bone socket, hemolytic staphylococci were isolated almost in pure culture, the ham looked, smelled, and tasted all right.

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EPIDEMIC 6

On the evening of 1 August, a group of 45 men arrived on this station. At 2100 they were given a meal of ham, eggs, spaghetti, bread, and coffee. Between 2300 that evening and 0800 the following morning 21 of these men were seen by medical officers because of abdominal cramps, diarrhea, nausea, vomiting, sweating, and prostration. Only a few of these men were hospitalized and most of them were on duty within 24 hours.

The entire group was interviewed regarding food consumed on the day prior to the outbreak, but the only food, consumption of which seemed out of proportion in the ill group, was ham. This is shown in table 4.

TABLE 4.—*Epidemic No. 6*

	Ill	Not ill	Total
Ate ham	21	19	40
No ham	0	5	5
Total	21	24	45

Further investigation disclosed that this ham had stood at room temperature for 3 hours and at ice-box temperature for 7 hours after having been skinned and boned. It had been served to a large number of men at the noon meal without harmful effect.

Bacteriologic study of several portions of this ham showed heavy growths of Staphylococcus aureus. All strains isolated produced wide zones of hemolysis on blood agar, and all liquefied Stone's medium, were coagulase positive, and fermented mannite with the production of acid.

EPIDEMIC 7

Late in the evening and through the night of 17 October a large number of men from two battalions in the service schools developed abdominal griping pain and low-grade diarrhea. The illness was mild; few had more than 2 or 3 watery bowel movements, and only one man was ill enough to require hospitalization. Nausea and vomiting were not features in this outbreak.

TABLE 5.—*Epidemic No. 7*

	Ill	Not ill	Total
Ate lunch	23	15	38
Did not eat	0	55	55
Total	23	70	93

(Chi-square value: 44.2)

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On the following morning small groups of the two battalions concerned were selected from the pay lines for interview. Data were secured by a show of hands. The only meal during the 2 days prior to the epidemic, which had been eaten by a larger percentage of the ill group than the well group, was the luncheon served about 9 hours before the onset of illness. This is shown in table 5.

The meal consisted of creamed chicken, carrots, asparagus, potatoes, lettuce, cake, bread, butter, coffee, and milk. The only one of these which showed a significant difference was the creamed chicken, as shown in table 6.

TABLE 6.—*Epidemic No. 7*

	Ill	Not ill	Total
Ate creamed chicken	26	13	39
Did not eat	0	59	59
Total	26	72	98

(Chi-square value: 53.4)

The fowls from which this creamed chicken had been made were cooked at about 2300 the evening before serving. They were then boned and diced and allowed to stand at room temperature until about 1100 the following morning when the pans were warmed and a cream sauce was added. This method of handling food was contrary to the station's commissary regulations. Several messmen who ate the chicken before the sauce was added became ill, but several who roasted some of the diced chicken just before the sauce was added did not become ill. No pathogens were isolated.

COMMENT

The causes of most epidemics of food poisoning may be surmised with considerable accuracy. The foods that cause illness are those which make good mediums for the growth of organisms, and are generally of animal origin (meat, fish, or dairy products). In addition they have usually undergone considerable handling in the preparation after the initial cooking, and have been rewarmed just prior to serving, or have been served cold. Foods in these categories are:

1. Ham.
2. Creamed chicken or fish.
3. Meat, fish, or chicken salads.
4. Croquettes, hashes, and goulashes.
5. Cream filled pies and pastries.

The usual deviation from the proper technic of food handling is in permitting the sliced or boned meat or the prepared food to stand

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for several hours at room temperature or in inadequately refrigerated ice boxes before it is served. Rewarming is insufficient, but thorough recooking just prior to serving will, despite improper handling, destroy the organisms and their toxins. The staphylococcus enterotoxin is said to withstand boiling for 30 minutes.

PLAN FOR INVESTIGATING FOOD POISONING EPIDEMICS

A plan for investigating epidemics of food poisoning was developed at this station.

Reporting of the epidemic.—If an unusual number of patients with gastro-intestinal disease report to sick call, that fact is immediately made known to the Epidemiology Unit. One or more members of the unit then visits the sickbay reporting the illness, taking with him data forms, specimen boxes for stools, and a copy of the week's menu. The medical officer or corpsmen in the sickbay are consulted for information.

Collection of data.—Those who were ill enough to be admitted to the hospital are interviewed individually, but the ambulatory ill are interviewed in groups, together with a number of well persons in the same companies. We have found it worth while to explain briefly to the men our object before questioning them, pointing out that the admission of illness on their part will not count against their Navy record. The ill are then segregated from the well, and further information concerning time of onset of symptoms, and meals and foods eaten is obtained by a show of hands. Data concerning meals and foods eaten are obtained likewise from those who developed no symptoms.

When the source of outbreak is apparent, additional information as to the exact time and food line in which the men were served the questionable food is obtained. The form shown on page 1213 has been helpful in getting the data systematically. By the use of this method and form as many as 100 men can be interviewed in less than half an hour. In collecting data it is useful to remember the rule-of-thumb that the span of time over which successive patients develop their symptoms is almost always longer than the incubation period of the illness. Thus, if the first symptoms are developed at 1600 and the last patient develops symptoms at 2300 of the same day, a span of 7 hours, the food causing the disturbance was probably served after 0900, and was probably the noon meal. Usually it will not be necessary to collect data on such foods as bread and freshly cooked vegetables, because these are only rarely involved in food poisoning.

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DATA FORM

COMPANY _____ BARRACKS _____ COMPANY COMMANDER _____
DATE _____
Total number of men _____ Number of men ill _____
Number of ill men interviewed _____
Number of well men interviewed _____

Day and time of onset

Day	Date	0000–0600	0600–1200	1200–1800	1800–2400

Symptoms: Diarrhea _____ Cramps _____ Nausea _____
Vomiting _____ Chills _____ Fever _____
Blood in stools _____ Other _____.

Meals eaten						Foods eaten				
Day	Meal	Sick		Not sick		Foods	Sick		Not sick	
		Ate	Didn't eat	Ate	Didn't eat		Ate	Didn't eat	Ate	Didn't eat
	Breakfast									
	Dinner									
	Supper									
	Breakfast									
	Dinner									
	Supper									
	Breakfast									
	Dinner									
	Supper									
	Breakfast									
	Dinner									
	Supper									
Places eaten						Time eaten				



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Galley inspection.—The galley in which the food was prepared and the mess hall where it was served are then investigated. Those who prepared it are interrogated concerning the details of preparation. Particularly important are the time of cooking, the amount of handling after cooking, where and for how long it was kept between preparation and serving, and whether it was recooked before serving and, if so, for how long. Refrigerator temperatures must be checked. General cleanliness of the galley serves as a good index of the care taken in the preparation of the food, but diseases will arise in the cleanest galley if the technic of handling food is improper. At this station samples of all foods served are retained in the ice box for 48 hours after serving, for bacteriologic analysis in the event of an outbreak of food poisoning.

This completes the initial part of the investigation. The data and the food samples are then brought back to the laboratory. Stool specimens are obtained as soon as practicable. After a brief review of the statistical data it is frequently possible to give a preliminary report to the senior medical officer and the commissary officer. The final report is made after the results of a more detailed statistical and bacteriologic investigation.

Statistical analysis.—Complicated mathematical analyses will rarely be necessary. It will usually suffice to arrange the data in simple tables, such as those illustrated herein. From these it can frequently be seen at a glance which meal and which food in a particular meal are responsible. If refinement is desired the Chi-square test can be applied. Two difficulties will be encountered occasionally. The occurrence of sporadic gastro-intestinal upsets accounts for there being at times patients who did not eat the questionable food. In addition, it will not infrequently be found that everyone or nearly everyone from the ill as well as from the non-ill has eaten a particular meal or a particular food. In that event it is impossible to detect the agency by statistical methods; the problem can be solved only on bacteriologic and inferential grounds.

Bacteriologic study.—Usually this is an unnecessary but interesting refinement. If a staphylococcus is isolated it should be tested for hemolytic properties, ability to liquefy the gelatin in Stone's medium, ability to ferment mannite, and ability to produce coagulase. The enterotoxin can be produced on semisolid medium and tested on kittens, but the results of this test are difficult to interpret. If a motile gram-negative rod which fails to ferment lactose in 14 days is found, a culture of the organism should be sent to the Salmonella Typing Center in Bethesda, Maryland. Nonmotile gram-negative rods should be tested for agglutination with the various types of antishigella sera. Stool examinations are sometimes useful. Salmonellae are usually present

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only in the first one or two watery movements, but the shigellae persist longer. A search for salmonellae in food handlers will rarely be productive, but members of the shigella group will often be found. Not infrequently staphylococci can be cultured from lesions on the hands of food handlers.

Because in the majority of outbreaks only a small portion of the total issue of food is contaminated, the chances of confirming the results obtained statistically, from small samples of food taken at random from the large amount of food served, are not good.

Control measures.—Epidemics of food poisoning will continue to occur when large numbers of men are messed together, so long as simple sanitary standards are not rigorously followed. Cleanliness is assumed, but the manner in which foods are cooked and held determines whether they become toxic. Some foods are better culture mediums than others. Indeed, cream puffs and similar cream-filled desserts have been causes so often that they should be eliminated from the diet. Ham has been a repeated source of poisoning at this station, so that special regulations now govern its preparation. It is skinned and boned before cooking and is refrigerated until boiling time. After it has been boiled for 2 hours it is cooled for 1 hour, transferred to roasting pans and roasted for half an hour, and then sliced while still hot. After it has been sliced, it is kept in an oven at 200° F. until served. Every effort is made not to have ham left over, but if it must be served again it is refrigerated until shortly before serving, when it is thoroughly roasted at 250° F. The chicken used in the preparation of chicken à la king and chicken salad should be boned and diced within 1 hour of serving. Meat loaf, meat croquettes, and ham pastes should never be served without thorough cooking at a high temperature immediately prior to the meal.

In addition to having regulations based on these principles for the commissary department, it will be found necessary to have all galleys and mess halls inspected daily by medical officers who are mindful of the many dangers in the preparation of food.

SUMMARY

1. Seven outbreaks of acute food poisoning in a large Naval training station are described. In 5 the causative food was determined, and in 3 bacteriologic confirmation was secured.

2. The methods used at this station for investigation of food-borne disease are described.

3. General measures designed to prevent food-borne illness are outlined.

Personnel of the Unit who rendered invaluable assistance are A. J. CALHOUN and R. L. VAN BUREN, pharmacist's mates, first class, and A. S. KENNEDY, pharmacist's mate, second class, U. S. N. R.

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THE EFFECTS OF BREATHING WELDING FUMES [1]

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The tremendous shipbuilding program and the decided advantages of welding over riveting in ship construction has brought about an enormous demand for arc welding. Welding consequently has become one of the foremost trades in shipbuilding and accounts for a large percentage of the employees of both Maritime and Navy contract shipyards.

Along with this expansion of the welding trade and the vast number of people engaged in it, there have occurred many rumors about the health hazards involved. Some of these rumors unfortunately have a basis in fact. The medical problem is to recognize the hazards, to apply measures to control them, and to dispel unnecessary fear of impairment to health by making these hazards and control measures known to the welder.

BACKGROUND

Type of welding.—There are several types of welding, but that generally used in the shipyard is the metallic arc type of electric arc welding. In this type of welding the electrode forms the filler metal, and virtually all the electrodes are of the coated variety. The arc is formed between the metal electrode and the base metal and temperatures generated in this process may reach up to 6,000° F. The electrode coating contains inorganic substances and organic binders, and its main purpose is to create a reducing atmosphere immediately around the weld pool in order to prevent undue oxidation. There are other advantages that the coated rod has over the bare rod, but this is the main advantage.

Health hazards.—The principal health hazards in welding as it is done in the shipyard are as follows: (1) Electric shock and burns; (2) radiant emanations consisting of ultraviolet and infra-red rays, which are invisible, and the visible rays of excessive intensity; and (3) gases and metal fumes arising in the arc. This article is concerned with the effects of breathing fumes generated in electric arc welding.

Composition of the fume.—The composition of the fume or "smoke" generated in the welding process depends on the composition of the

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base metal, electrode, and coating. In general the "smoke" consists of oxides of metals, and small quantities of such gases as oxides of nitrogen, ozone, carbon dioxide and carbon monoxide. The consensus is that the fume is made up largely of iron oxide (*1*). If the base metal is coated with zinc, the fume will contain zinc oxide. When the iron or steel has been painted prior to welding, products of decomposition of the paint will be added to the welding "smoke."

METAL FUME FEVER

Among welders the most common complaint due to the inhalation of fumes occurs after welding galvanized material. This happens most often in Navy contract shipyards where galvanized metal is used to prevent too rapid corrosion by sea water. In Maritime contract yards galvanized pipe is used, so that these yards have welders who sometimes complain of this condition. When galvanized material is welded, zinc oxide fumes escape into the atmosphere somewhat as they do in foundries manufacturing bronze or brass. Inhalation of these fumes in sufficient amounts for a period of time brings on an attack of metal fume fever (*2*). This condition is fairly well known among welders and is referred to by them as "zinc chills," "galvo" or "galvanize poisoning."

After approximately a half hour of breathing fumes with sufficient concentration of zinc oxide, the workman may note a metallic, sweetish taste, and a tendency to cough accompanied by a feeling of irritation under the sternum on taking a deep breath. In from 4 to 6 hours symptoms typical of the onset of an acute respiratory infection develop with mild headache, malaise, backache, vague pains, and sensation of "tenderness" about the eyes. It is not infrequent for some to develop nausea at this time. This is soon followed by a chill, not unlike the chill of malaria, and the development of fever of 101° to 103° F. In about 12 hours the temperature returns to normal, but the person feels weak, has a headache, vague muscular pains, stiffness in the joints, and lacks energy. Many are nauseated and are unable to retain food, and it frequently makes them miss a day's work. It has been shown experimentally, however, that attacks of metal fume fever on two successive days are rare (*3*). Recurrences however occur most often after a "lay-off" period.

It is important to remember the following about zinc fume fever: (1) There is no permanent disability; (2) the condition is transitory; (3) there are no known complications; and (4) it does not predispose to lung diseases, such as tuberculosis.

If the concentration of zinc fume in the working atmosphere is maintained below 15 mg. per cubic meter for an 8-hour exposure and below 45 mg. per cubic meter for short exposures, it is unlikely that metal fume fever will occur (*4*).

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Fresh oxides of copper, silver, mercury, cobalt, magnesium and several other metals will produce similar febrile reactions, but these metals are not encountered as frequently as is zinc.

Cadmium fumes cause a more severe febrile reaction with marked prostration, abdominal pain, pulmonary irritation, edema, nausea and vomiting. Fortunately exposure to these fumes in concentrations sufficient to cause symptoms is not experienced in shipyards, as cadmium-coated steel is seldom, if ever, used.

It is questionable whether metal fume fever can be acquired by inhaling iron oxide from noncoated black iron welding. No case of this type has been encountered and none has been reported in the literature. This is the most common of any of the metallic oxides formed in shipyard welding. This fume, however, should be removed at its source, particularly in confined spaces, because high concentrations of ferric oxide may cause some irritation of the respiratory mucosa.

SIDEROSIS

Enzer and Sander (*5*) have reported chronic lung changes due to the deposition of ferric oxide in electric arc welders who used bare electrodes in confined spaces over a number of years. This condition is known as "siderosis" and is similar to coal dust deposits in the lungs found in urban dwellers. Siderosis does not produce clinical symptoms, disability, or increase susceptibility to complicating lung infections. It is unlikely that any irritation of the respiratory tract, or a perceptible deposit of ferric oxide in the lungs will occur if the concentration of ferric oxide in the working atmosphere does not exceed 30 mg. per cubic meter.

LEAD POISONING

Another metal fume hazard is lead poisoning. This is particularly true in Maritime contract shipyards, as the priming coat of paint frequently used is one containing a red lead pigment. In order to save time small parts, and at times prefabricated sections, are given a coat of paint in the yard and later welded into place on the hull. The heat from the arc boils off the lead and exposes the welder and others working in the vicinity to high concentrations of vaporized lead. The concentration of lead at the breathing zone should not be over 1.5 mg. per 10 cubic meters for an 8-hour exposure. We know that at times welders must be exposed to concentrations many times this recommended limit. The short time exposure in any one incidence apparently accounts for the low incidence of lead poisoning among welders in shipyards where lead pigment paint is used. Moreover, the frequent rotation of workers has spread the exposure time over a large number

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of men, whereas the practice of leaving from 4 to 6 inches along the edges of plates unpainted has materially reduced the hazard of poisoning from this source.

In repair of old ships that have received many coats of lead pigment paint, lead poisoning is likely to occur unless proper protective measures are taken (*6*).

ZINC CHROMATE REACTION

Welding on surfaces coated with zinc chromate is common in Navy contract yards, and in Maritime yards constructing vessels for the Navy. Investigation by the U. S. Public Health Service has shown that under normal working conditions the concentration of chromate (as chromic acid) is well below the permissible working concentration established by the American Standards Association. However, welding, burning and shrinking of steel plates coated with zinc chromate primer in confined spaces may produce an atmosphere that will cause irritation to the upper respiratory tract and cough owing to the evolution of phthallic anhydride.

GASES

Among the gases arising in the arc are the oxides of nitrogen. There have been a few deaths ascribed to them, but these occurred in unventilated confined places (*7*), when the bare electrode was in general use. The process of nitrogen fixation in the manufacture of nitric acid and nitrates is sometimes accomplished commercially by use of the carbon arc. Nitrogen peroxide is formed in electric arc welding in minute amounts (*11*). This gas is toxic and will produce death from pulmonary edema if breathed in overdosage.

It is unlikely that overdosage will ever occur in welding as it is done in shipyards, unless an unusually abnormal amount of welding is done in a confined unventilated space. The consensus is that concentrations will never rise to toxic levels where welding is done in the open or in adequately ventilated confined places. In recent years investigators have found that toxic amounts of nitrogen peroxide are not present in the breathing zone of welders under present welding conditions (*7*).

Ozone may be formed in the welding arc and in concentrations of over 1 part per million may act as a pulmonary irritant (*8*). Titus, Warren and Drinker, and Naske, report the odor of ozone is present near the arc in welding. However, Naske found only 0.7 mg. per cubic meter of ozone at the breathing zone. On leaving the arc, ozone disintegrates rapidly and actually does not present a hazard in welding.

Carbon dioxide is formed from combustion of the organic substances



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in rod coatings. At high temperatures, such as exist at the arc, carbon dioxide dissociates to form carbon monoxide and oxygen; however, on cooling, they recombine to form carbon dioxide. Under ordinary conditions of welding it seems that danger from these gases is slight and should be of no concern if ordinary precautions are taken.

PNEUMONIA

There has been some apprehension among welders as to whether welding may make them more susceptible to upper respiratory infections and pneumonia. This may have been incited by reports from some investigators that welders have frequent colds and upper respiratory tract infections. Other investigators, notably Sander, state that workers who were susceptible to colds noted that this susceptibility disappeared after they began welding.

A study has recently been made of 864 cases of pneumonia among shipyard workers (*9*). It was found that pneumonia occurs no more frequently among welders than among other workers in the shipyards, and that the worker's previous occupation and residence bear no relation to the incidence of pneumonia.

Metal fume fever and nitric fume poisoning are at times spoken of erroneously as "welder's pneumonia." Since there is no specific pneumonia of welders as such and as it gives rise to a misconception in the minds of both laymen and physicians this term should be discarded.

The terms that more appropriately designate the condition and should be used are "zinc fume fever" for the transient illness, and "pneumonia complicating nitric fume poisoning" for the more serious entity (*10*).

There is little doubt that working in unventilated, confined spaces will cause pollution of the atmosphere which will produce symptoms simulating respiratory infection. Men working on jobs under these conditions may develop a cough that disturbs them, particularly at night. The cough may be productive of sputum that contains iron oxide and traces of blood. There may be considerable loss of sleep and all the accompanying symptoms. This causes apprehension on the part of the worker and members of his family. The fear is particularly of tuberculosis, but the subjects have no night sweats, afternoon rise in temperature or loss of weight, and the chest is generally normal on x-ray examination. Adequate ventilation on the job should be provided for these men. This is a transitory condition and disappears when a shift is made to a job where the welding fume exposure is slight (*9*).

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SEXUAL DISTURBANCES

Rumors have been circulated among welders that the occupation of welding will cause impotence and sterility. There are no facts to support these rumors. Impotence may be a symptom of lead intoxication and should a welder complain of this symptom an investigation should be made to determine whether or not he has lead poisoning. The chances are that this symptom will have a psychic basis—a frequent cause of impotency.

Considerable unrest has developed among both men and women welders because of the rumor that the welding arc gives off x-rays that will cause sterility. Therapeutic sterility is sometimes accomplished by the medical profession by the use of x-rays. The machines used for this purpose operate at 100,000 or 200,000 volts; all welding machines operate at from 20 to 80 volts and cannot produce x-rays (*11*).

CONTROL MEASURES

There are some health hazards in welding, particularly in confined spaces. These should not be minimized; adequate control measures should be instituted. Absence of such measures has resulted in curtailment of production from: (1) Stoppage of operations due to high fume concentrations and going topside for a breathing spell; (2) high labor turnover of welders giving reason for termination as "poor health" or "burned out"; (3) demands by groups of welders for x-ray of the chest and physical examinations; and (4) demands for premium pay for working in poorly ventilated spaces.

It is felt that the best protection for the welders and others working in the vicinity is local exhaust ventilation accomplished by moving a minimum of 200 cubic feet of air per minute at the outlet of a flexible exhaust hose and maintaining the end of the hose within 8 inches of the arc. This distance may be increased by moving more air but involves higher cost. Methods of protection other than ventilation serve to protect welders, but do not protect others working in the vicinity.

General and local exhaust ventilation will be adequate for shipyard welding if the ventilation standards as recorded in the "Minimum Requirements for Safety and Industrial Health in Contract Shipyards" are carried out.

For protection against the fumes from welding when the exposure is short the individual welder may be protected by a respirator approved for metal fumes by the U. S. Bureau of Mines.

When there is welding to be done in confined spaces and ventilation is impracticable, adequate protection may be provided by the welder wearing an approved air-supplied respirator or hose mask.

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When is ventilation necessary?—It may be said that when the fumes in a compartment reach a concentration sufficient to make visibility poor, ventilation is needed. If the concentration of fumes is not allowed to increase beyond 30 mg. per cubic meter, it is unlikely that any fume or gas hazard will exist even in confined spaces.

Device for ventilating welders' hoods.—A new compressed air unit for ventilating welders' hoods has recently been described (*12*). This unit consists of a metal attachable tube bent to form a rectangle, and completely surrounds the glass window. This metal tubing contains perforations to direct an outward spray of air. The compressed air tubing connects directly to this metal tube. The following comments are made concerning this device:

1. Welding fumes do not enter the hood even when welding directly over and close to the arc.
2. The atmosphere in the mask is cool, which prevents perspiration and soiling of the eyes.
3. A constant quantity of fresh air is supplied the welder.
4. It prevents the necessity of using alternating shifts of men on galvanized welding jobs.
5. The men like the device and voluntarily wear it after trying it.

This device protects the welder himself, but does not provide protection for others working in the same compartment. In order that this latter may be accomplished, removal of the fumes by exhaust ventilation at their source seems to be the best plan.

When ventilation and protective devices are provided there is sometimes difficulty in getting the men to use them. Inauguration of an educational program to acquaint welders with the hazards and the proper use of protective equipment is in order. This educational endeavor should begin in the welding school and extend to the supervisory force, for it is this latter group that will decide the success or failure of any health or safety procedures.

Medical control measures consist of a preplacement examination and an annual physical examination. It is desirable that an x-ray examination of the chest accompany the physical examination. Moreover welders who handle lead-coated surfaces should have a basophilic aggregation test of the blood every three months. A better lead index, however, is an examination of the urine. Patients that show an excretion of lead above the normal limits should be shifted to a job not involving a lead hazard.

CONCLUSIONS

1. There are health hazards connected with electric arc welding from breathing the fumes and gases generated. These hazards should not be minimized.

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2. The working atmosphere can be made safe by adequate ventilation.

3. When ventilation is impracticable the individual welder may be protected by the use of approved respiratory protective equipment.

4. An educational program is necessary to acquaint welders with the hazards in their trade and the proper protective measures to be instituted to control these hazards.

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Hitch, Joseph M., Lieutenant Commander (MC) USNR (*Dermatitis Venenata Caused by Semecarpus Atra*, p. 1111). A. B., University of Delaware, 1929; M. D., 1933, and M. S. in dermatology, 1938, University of Virginia Department of Medicine. Intern: University of Virginia Hospital, April 1933–34; University of Oklahoma Hospital, July 1934–35; assistant resident, dermatology and syphilology, Cleveland City Hospital, July 1935–July 1936; resident, dermatology and syphilology, University of Virginia, July 1936–July 1937; instructor and fellow in dermatology and syphilology, University of Virginia Department of Medicine, July 1937–July 1938; private practice, dermatology and syphilology, Raleigh, N. C., July 1938–; instructor in dermatology and syphilology, Duke University, July 1938–; staff, Rex Hospital, Raleigh, N. C.; physician, Wake County Clinic for Control of Syphilis. Fellow American Medical Association; member: Wake County Medical Society; Medical Society of the State of North Carolina; Southern Medical Association; Society for Investigative Dermatology; American Academy of Dermatology and Syphilology.

Jacox, Harold W., Commander (MC) USNR (*Organic Upper Gastro-intestinal Disease at an Advance Base*, p. 1035). M. D., University of Michigan Medical School, 1928. Intern, U. S. Naval Hospital, Boston, 1928–29; intern, 1929–30, and assistant resident, Department of Roentgenology, 1930–31, University Hospital, Ann Arbor, Mich.; instructor, Department of Roentgenology, 1931–32, and assistant professor of radiology, 1932–36, Michigan University; director, Department of Radiation and Physical Therapy, Western Pennsylvania

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Hospital, Pittsburgh, 1936–. Member: American Medical Association; American Roentgen Ray Society; Radiological Society of North America; Pittsburgh Academy of Medicine. Diplomate American Board of Radiology.

Kern, Richard A., Captain (MC) USNR (*Observations on Bacteriology and Epidemiology of Acute Respiratory Tract Infections in the Tropics*, p. 1039). A. B., University of Pennsylvania, 1910; M. D., University of Pennsylvania School of Medicine, 1914. Instructor, medicine, University of Pennsylvania, 1916–21; associate, University of Pennsylvania School of Medicine and Graduate School of Medicine, 1921–28; assistant professor, 1928–34; professor, clinical medicine, 1934–; assistant physician, University Hospital. Fellow American College of Physicians; member: American Medical Association; Association of American Physicians; American Society for Clinical Investigation; Society for the Study of Asthma (president 1934); American Clinical and Climatological Association; American Association for the Study of Allergy (president 1931); College of Physicians of Philadelphia; Pathological Society of Philadelphia. Diplomate American Board of Internal Medicine.

LeCocq, Edward A., Commander (MC) USNR (*Ununited Fracture of the Clavicle*, p. 1166). M. D., University of Oregon Medical School, 1929. Intern, Multnomah Hospital; Hospital for Ruptured and Crippled, 1930–31; private practice, Seattle, Wash., 1931–; hospital staff memberships: Kings County Hospital; Children's Orthopedic Hospital; Swedish Hospital; Providence Hospital; and Columbus Hospital, Seattle, Wash. Diplomate American Board of Orthopaedic Surgery.

Llewellyn, John S., Lieutenant (MC) USNR (*Procaine Tolerance*, p. 1159). B. A., University of Arizona, 1938; M. D., Loyola University School of Medicine, 1940. Intern, St. Luke's Hospital, Chicago, Ill., 1940–42.

McCullough, Clifford P., Commander (MC) USNR (*Procaine Tolerance*, p. 1159). B. S., University of Chicago, 1911; M.D., Rush Medical College, 1914. Intern, Presbyterian Hospital, Chicago, 1914–16; associate in pathology, Dr. Ludwig Hektoen, 1913–14, and instructor, Rush Medical College, 1916–21; staff member Alice Home Hospital, Lake Forest, 1919–; general practice, 1917–. Member: Lake County Medical Society (president 1935 and 1936); American Medical Association; Chicago Society of Internal Medicine.

McLaughlin, Charles W., Jr., Lieutenant Commander (MC) USNR (*Postoperative Urinary Retention*, p. 1025). B. S., University of Iowa, 1927; M. D., Washington University School of Medicine, St. Louis, 1929. Resident in pathology, Montreal General Hospital, 1930–31; fellow in surgery, University of Pennsylvania Hospital, 1931–34; graduate study, Royal Infirmary, Edinburgh, Scotland, 1934–35; private practice, Omaha, 1935–; assistant professor of surgery, University of Nebraska; surgeon: University of Nebraska Hospital, Nebraska Methodist Hospital, and Bishop Clarkson Memorial Hospital, Omaha. Member: Nebraska State Medical Society; American Medical Association; Central Surgical Association; American College of Surgeons; Western Surgical Association. Diplomate American Board of Surgery.

Michael, Paul, Commander (MC) USNR (*Filariasis Among Navy and Marine Personnel*, p. 1059). M. D., McGill University Faculty of Medicine, 1928. Intern, Alameda County Hospital, 1928–29; resident in pathology, California University, 1929–31; assistant pathologist, Alameda County Hospital; pathologist, Children's Hospital, Peralta Hospital; assistant professor, University of California. Fellow American Medical Association; member: American Society

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of Clinical Pathologists; International Association of Medical Museums. Diplomate American Board of Pathology.

Moosey, George A., Lieutenant (MC) USNR (*Multiple-Purpose Emergency Splint*, p. 1187). A. B., Fairmont State College, 1927; B. S. in medicine, West Virginia University, 1931; M. D., Medical College of Virginia, 1933. Intern: Harper Hospital, Detroit, Mich., 1933–34; Northern Pacific Hospital Association, Tacoma, Wash., 1934–38; private practice, Western Clinic, Tacoma, Wash., 1938.–. Fellow American Medical Association; member: Pierce County Medical Society; Tacoma Internists Society.

Myers, Stanley A., Lieutenant (MC) USNR (*Early Care of Facial Wounds*, p. 1019). M. D., University of Colorado School of Medicine, 1932. Intern, 1932–33, and house surgeon, 1933–34, Youngstown Hospital; intern, Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York, N. Y., 1934–35; resident, Massachusetts Eye and Ear Infirmary, Boston, 1935–37; assistant, Ear, Nose and Throat Service, Youngstown Hospital. Fellow American Medical Association; member: American Academy of Ophthalmology and Oto-laryngology. Diplomate American Board of Otolarynogology.

Neel, Harry B., Lieutenant (MC) USNR (*Venipuncture*, p. 1178). A. B., Washington and Lee University, 1928; M. D., Johns Hopkins University School of Medicine, 1932; M. S. in surgery, University of Minnesota, 1940. Intern: Johns Hopkins Hospital, 1932–34; Hospital for Women, Baltimore, Md., 1934–35; fellow in surgery, Mayo Foundation, 1936–40; surgeon: Albert Lea Medical and Surgical Center; Naeve Hospital, Albert Lea, Minn. Fellow American College of Surgeons; member: American Medical Association; Minnesota State Medical Association. Diplomate American Board of Surgery.

Norris, Robert F., Lieutenant Commander (MC) USNR (*Observations on Bacteriology and Epidemiology of Acute Respiratory Tract Infections in the Tropics*, p. 1039). A. B., Princeton University, 1928; M. D., University of Pennsylvania School of Medicine, 1932. Intern, Pennsylvania Hospital, Philadelphia, 1932–34; assistant in pathology, Johns Hopkins University, 1934–35; assistant director, Ayer Clinical Laboratory, Pennsylvania Hospital, Philadelphia, 1935–41; assistant instructor in pathology and medicine, University of Pennsylvania, 1936–41. Fellow: American Medical Association; College of Physicians of Philadelphia; member: American Associations of Pathologists and Bacteriologists; American Association for the Advancement of Sciences.

Overton, Marvin C., Jr., Commander (MC) USNR (*Perforating Wounds of the Chest*, p. 1021). M. D., Baylor University College of Medicine, 1929. Intern, Mercy Hospital, Slaton, Texas, July 1929–July 1932; owner and surgeon, Worley Hospital, Pampa, Texas. Fellow American Medical Association; member: Gray-Wheeler County Medical Society; Texas State Medical Society; American Association of Industrial Surgeons.

Phillips, Richard B., Commander (MC) USNR (*Severe Burn: Case Report*, p. 1162). B. A., University of Wyoming, 1926; M. B., Ch. B., 1932, M. D., Edinburgh University Medical School, 1933; Harvard Postgraduate Medical School, 1935–36. Resident, Rotunda Hospital, Dublin, Ireland, 1932; resident, Allgemeines Krankenhaus, Vienna, 1933; private practice and assistant in gynecology, Tufts Medical School, 1934–36; surgical fellow, Mayo Clinic, and resident, St. Mary's Hospital, Rochester, Minn., 1936–40; private practice, Rochester, N. Y., 1940–; anesthetist, Rochester General Hospital, and Highland Hospital, Rochester, N. Y. Member: Massachusetts, Minnesota, and

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New York State medical societies; American Medical Association; British Medical Association; New England Society of Gynecology and Obstetrics; American Society for the Control of Cancer; American Society of Anesthetists; diplomate National Board of Medical Examiners; licentiate Royal College of Surgeons (Edinburgh), 1933; Royal Faculty of Physicians and Surgeons (Glasgow), 1933; Diplome de la Faculté de Medécine de la Université de Paris.

Pollock, Benjamin, Lieutenant Commander (MC) USNR (*I. Dried Plasma Sheets in Treatment of Burns: II. In Treatment of War Wounds*, p. 1171). M. D., Tufts College Medical School, 1922. Intern, Boston City Hospital, 1923; instructor in pathology and bacteriology, Tufts College, 1923–25; private practice, Miami Beach, Fla. Fellow American Medical Association; member Dale County Medical Society.

Rogers, William L., Commander (MC) USNR (*Value of Sulfonated Oils in the Treatment of Burns and Other Denuded Surfaces*, p. 1125). A. B., Stanford University, 1923; M. D., Stanford University Medical School, 1926; attended University of Hamburg, 1929–30, and the University of Vienna, 1930–31. Private practice, San Francisco, 1926–; assistant clinical professor of surgery, Stanford University Medical School, 1927–; consultant surgeon: U. S. V. B., 1929–; French Hospital, 1931–39; Southern Pacific Hospital, 1938; chief of staff, French Hospital, 1939–; assistant clinical professor in surgery, Stanford University Medical School. Fellow American Medical Association; member: American Association for Thoracic Surgery; San Francisco Surgical Society; California Academy of Medicine; American Tuberculosis Association; California Trudeau Society.

Schmitt, George F., Lieutenant (MC) USNR (*Present Status of Penicillin*, p. 1041). M. D., University of Maryland School of Medicine and College of Physicians and Surgeons, 1935; B. S., University of Maryland, 1935; M. S. in medicine, University of Minnesota, 1943. Intern, University Hospital, Baltimore, Md., 1935–37; fellow in pathology, University of Maryland School of Medicine and College of Physicians and Surgeons, 1937–38; fellow in medicine, Mayo Foundation, University of Minnesota, July 1938–August 1941. Fellow: American Medical Association; American College of Physicians; member: Southern Minnesota Medical Association; Minnesota State Medical Association; Olmsted-Houston-Fillmore-Dodge Counties Medical Society. Diplomate American Board of Internal Medicine, 1943.

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Short, James J., Commander (MC) USNR (*Treatment of Meningococcic Meningitis*, p. 1156). M. D., University of Buffalo School of Medicine, 1918. Instructor: chemistry, New York Post-Graduate Medical School of Columbia University, 1918–20; medicine, College of Physicians and Surgeons, Columbia, 1921–23; instructor, associate, and assistant professor, New York Post-Graduate Medical School, Columbia, 1923–35; associate clinical professor of medi-


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cine, 1935–. Chief of medical clinic and associate attending physician, New York Post-Graduate Hospital; research director and associate director, Life Extension Examiners, New York; director medical service, Department of Correction Hospitals, New York; attending physician, Welfare Hospital for Chronic Diseases, New York. Fellow: American College of Physicians; American Medical Association; member: New York County and New York State medical societies. Diplomate American Board of Internal Medicine.

Slagle, George W., Lieutenant (MC) USNR (*Treatment of Meningococcic Meningitis*, p. 1156). B. S. in medicine, University of Michigan, 1931; M. D., University of Michigan Medical School, 1933. Intern, Miami Valley Hospital, Dayton, Ohio, July 1933–July 1934; staff member, internal medicine, Battle Creek Sanitarium, July 1934–Sept. 1937; private practice, Battle Creek, Michigan, July 1934–. Fellow: American College of Physicians; American Medical Association; member: Calhoun County and Michigan State medical societies; International Gastro-enterological Association.

Stanbury, John B., Lieutenant Commander (MC) USNR (*Food Poisoning at a Naval Training Station*, p. 1205). A. B., Duke University, 1935; M. D., Harvard Medical School, 1939. House officer, House of the Good Samaritan, Boston, Jan. 1940–April 1940; intern, Massachusetts General Hospital, Boston, April 1940–41.

Steele, Edson H., Commander (MC) USNR (*Psychiatric Casualties*, p. 1089). M. D., Albany Medical College, 1919. Intern: Bellevue Hospital and Gouverneur Hospital, New York, N. Y., 1919–20; Los Angeles County Hospital, 1920–21; assistant surgeon, U. S. Public Health Service Hospital No. 37, Waukesha, Wis., 1921–23; attending psychiatrist, Los Angeles County Psychopathic Hospital. Fellow American Medical Association; member American Psychiatric Association. Diplomate American Board of Psychiatry and Neurology.

Sweet, A. Porter S., Lieutenant Commander (DC) USNR (*Radiography of the Neck of the Condyle*, p. 1135). D. D. S., University of Buffalo, 1918. General practice, Hornell, N. Y., 1918; staff dentist, St. James Mercy Hospital, Hornell, N. Y., 1936; consulting dentist, Bethesda Hospital, Hornell, 1937; editor, Dental Radiography and Photography, 1938; associate editor (radiodontics), Journal of the Dental Society of the State of New York, 1939; consulting dental radiologist, research dept., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y., 1942. Member: American Dental Association; Dental Society of the State of New York; Seventh District Dental Society; Rochester Dental Society; Pierre Fauchard Academy; American Association for the Advancement of Science (Dental Subsection); International Association for Dental Research; Rochester Academy of Science.

Toomey, Lawrence O., Commander (MC) USNR (*Treatment of Meningococcic Meningitis*, p. 1156). A. B., Western State Teachers College, 1924; M. D., University of Louisville Medical School, 1930. Intern, Kentucky State Tuberculosis Sanatorium, 1929–30; Charity Hospital, New Orleans, La., 1930–31; private practice of medicine, Bowling Green, Kentucky, 1931–. Member: American Medical Association; American Trudeau Society; American College of Chest Physicians; Kentucky State Medical Association; Warren County Medical Association.

Toumey, James W., Lieutenant Commander (MC) USNR (*Soft Tissue Protection in Fracture Treatment*, p. 1143). M. D., Columbia University College of Physicians and Surgeons, 1926; D. Sc. in orthopedic surgery, Columbia Uni-

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versity, 1933. Intern, Presbyterian Hospital, New York, N. Y., 1926–28; resident, 1928–30, and fellow, 1930–33, New York Orthopedic Dispensary and Hospital, New York, N. Y.; appointed orthopedic surgeon, Lahey Clinic, Boston Mass.; orthopedic surgeon: New England Baptist Hospital, Boston, Mass.; New England Deaconess Hospital, Boston, Mass. Fellow: American College of Surgeons; American Medical Association; member American Academy of Orthopaedic Surgeons. Diplomate American Board of Orthopaedic Surgery.

Upham, Harvey C., Lieutenant, junior grade H–V(S) USNR (*Food Poisoning at a Naval Training Station*, p. 1205). A. B., 1939, and M. A. in bacteriology, 1941, University of California at Los Angeles. Research assistant in marine bacteriology, 1941–42, Scripps Institution of Oceanography (University of California), La Jolla, Calif.

Vance, Cyril L., Lieutenant (MC) USNR (*Burns and Their Treatment*, p. 1129). B. S., Brigham Young University, 1934; M. B., Northwestern University, 1937; M. D., Northwestern University Medical School, 1938. Rotating internship (2 years), Dr. W. H. Groves Latter-Day Saints Hospital, Salt Lake City; private practice, Salt Lake City. Member: American Medical Association; Utah State Medical Society; Salt Lake County Medical Society.

Wallin, Stanley P., Commander (MC) USNR (*Simple Method of Converting Stokes Stretcher-Type Jeep Ambulance Into a Field Litter-Type Ambulance*, p. 1184). B. S., University of Nebraska, 1926; M. D., University of Nebraska College of Medicine, 1926. Private practice, Cheyenne, Wyo., 1926–.

Watts, Daniel T., Lieutenant, junior grade H–V(S) USNR (*Syncopal Reactions of Anoxic Subjects Observed in the Low Pressure Chamber*, p. 1103). A. B., Elon College, 1937; Ph. D., Duke University, 1942. Graduate assistant in physiology, Duke University, 1939–42.

Willard, John H., Commander (MC) USNR (*Acute Infectious Jaundice*, p. 1085). B. A., Carleton College, 1923; M. D., University of Pennsylvania School of Medicine, 1927. Private practice, internal medicine, 1928–; assistant professor of gastro-enterology at the Graduate School of Medicine, University of Pennsylvania; assistant in medicine, Lankenau Hospital; physician-in-chief, gastro-enterological department, Abington Memorial Hospital, Abington, Pa. (staff member since 1931). Fellow: American College of Physicians; American Medical Association; member: American Gastro-enterological Association; Philadelphia College of Physicians.

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BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112

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COVER PHOTOGRAPH

Once a bloody battleground, the palm-fringed beaches of Guadalcanal today are a Pacific crossroads to wounded and sick fighting men who are under evacuation. The patients shown have come from New Georgia, some by air and others by sea, and are to be sent farther to the rear by a U. S. Navy hospital ship.

—Official U. S. Marine Corps Photo.

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NAVY DEPARTMENT.
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

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Commander, Medical Corps,
United States Naval Reserve.
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U. S. NAVAL MEDICAL BULLETIN

VOL. 42 JUNE 1944 No. 6

SPECIAL ARTICLES

DENGUE

ANALYSIS OF THE CLINICAL SYNDROME AT A SOUTH PACIFIC ADVANCE BASE

FRANZ H. STEWART
Lieutenant Commander (MC) U. S. N. R.

On this island dengue has caused illness in over 25 percent of the military population, resulting in 80,000 sick days among the armed forces. There have been no deaths. Mosquitoes of the aëdes group are found in abundance on the island.

The disease follows a characteristic clinical pattern which can be recognized readily at the bedside.

1. Onset.—The onset of symptoms may be abrupt. Often the patient can give the hour of the day his symptoms began. An individual who feels well at breakfast may become ill and be admitted to the wards by lunch time. Occasionally the disease may begin during the night and wake the man from a sound sleep. In other instances there may be a period of premonitory symptoms which lasts anywhere from 5 to 30 hours. A prodromal period longer than this is unusual. In mild cases there may be several days of vague body aches and malaise.

2. Early symptoms.—Frontal headache and pain in or behind the eyes, pain on movement of the eyes, and pain low in the back are symptoms which occur early and are quite characteristic. In the first day or two of the disease there may be chilly sensations and occasionally a brief shaking chill. Often there is loss of appetite, and in some cases there is nausea, vomiting, and abdominal cramps. Dizziness in the first few days is not unusual.

The frontal headache is described as a constant ache, usually just above the eyes, often associated with pain in the eyes or back of the eyes. The pain in the back is an ache located in the lower lumbar region and described as being across the back and difficult to localize accurately. Movement does not appear to exaggerate the discomfort and there is no tenderness. The chilly sensations make the sufferer use

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a blanket on a hot day; the chill is a true teeth-chattering chill which lasts several minutes.

There may be aches and pains in or about several joints, and there may be pains in the muscles of the legs, arms, and neck. These symptoms rarely amount to severe pain, but serve to make the patient restless and cause him to change his position frequently. These vague aches and pains are not as severe as the "breakbone" pains and painful spasticity of pretibial muscles described by those who have seen dengue in the Philippines and China in past epidemics.

3. Early physical findings.—The patient usually walks in and is obviously uncomfortable. His temperature is about 103° F., and his face is flushed even more than would be expected from the fever. He gives the appearance of having been exposed to the sun, his eyelids are swollen, and the puffy upper lids may be white. During examination there is a hint of excitability and movements may be unexpectedly quick. When questioned about headache, the patient points out the painful area on the forehead just above the eyes.

The eyeballs appear white between the puffy lids. On close observation dilated conjunctival vessels are seen extending from the periphery but not reaching the iris. There is little diffuse injection of the bulbar conjunctivae. In most cases light does not cause distress. There is no increase in lacrimation. The examiner is surprised at the diffuse redness of the lower lid when his finger pulls down the surrounding tissues to expose the palpebral conjunctivae. There is little difference in the appearance of the two eyes.

The eyeballs are tender to pressure, and the patient complains of pain on movement of the eyes and may be unwilling to follow the examiner's finger when it is moved from side to side. This pain on pressure and on movement is a good diagnostic point when present but can be expected in only about one patient in four.

The nose is not obstructed and is dry. There is a striking lack of catarrhal signs. The throat appears dry and moderately injected. In some patients petechial-like spots may be seen on the soft palate.

A chain of pea-size lymph nodes is felt at the base of the neck over the posterior scalenus muscles. These nodes are not tender, vary in size, and are not found in the suboccipital region as is the case in German measles.

The pulse is moderately rapid during the first day, possibly 90 to 120. Later the pulse becomes slow and in spite of high fever there is bradycardia. Often the pulse is below 60. In one patient the pulse remained below 40 beats per minute. There is no irregularity, and the pulse remains slow even though the temperature rises. The electrocardiogram shows a simple sinus bradycardia.

The heart and lungs show no changes at the time of admission.

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The abdomen may be vaguely tender and in about 10 percent of the patients the spleen is palpable. The spleen may or may not be tender and it changes in size during the illness. It may not become palpable for the first day or two and may recede quickly, or it may remain enlarged, extending several centimeters below the costal margin for days after the patient is apparently cured.

4. Clinical course.—The temperature curve and the patient's discomfort parallel each other, but the pulse remains slow. During the first day or two when the fever is high the patient is very uncomfortable, but often on about the third day the temperature falls to a normal level for from several hours to 2 days. During this lull the patient feels better and unless care is taken he may be discharged as well. Soon (usually on the fourth or fifth day) the fever returns and with it comes a return of the discomfort. This second spike of fever is often higher than the first febrile period.

Recovery is by crisis. The patient is very uncomfortable and has a fever up to 105° F. Since he has been ill for some 5 days there is doubt of the diagnosis. Suddenly a drenching sweat occurs and the fever subsides. Usually the fever does not again return, but may touch 100° to 101° F. for 1 or 2 days.

This type of temperature curve, with high fever at both ends of the illness, is characteristic and suggests the type of curve described as "saddle" temperature. This occurs in about 25 percent of cases. A less definite but suggestive saddleback curve occurs more frequently. The valley between the beginning and terminal fever does not always reach normal. In dengue a fever of 103° F. or over is expected and a temperature of 105° F. is not exceptional. In some cases the fever subsides on about the fourth day and does not return. The symptoms follow the temperature curve.

In less typical cases the temperature spikes daily to 101° F., but even then discomfort follows the same curve, and after about 5 to 7 days returns to normal. Regardless of the type of temperature curve presented, the fever will not last beyond 7 days and more often is over by the fifth day. This is a disease of 1-week duration.

5. Rash.—The skin manifestations of this febrile disease are at first confusing but there are certain features which characterize this clinical pattern. For convenience the various skin manifestations are classified as rash *A* and rash *B*.

Rash *A* is a toxic type. It occurs on the third, fourth, or fifth day, is variable in appearance and quite evanescent. The flushing of the skin over the shoulders and the chest increases and a morbilliform rash occurs, especially over the back and sides of the chest. It fades on pressure. A few petechiae may appear in the axillae. At this stage the disease closely resembles rubella, red eyes, cervical nodes, and a

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morbilliform rash being characteristic. When the fever drops the rash fades.

Rash *A* may appear as a scarlet, diffuse redness of the chest and shoulders and over the extensor surfaces of the arms. It may last several days. Islands of normal skin, half the size of a dime, give the appearance of white spots scattered over the scarlet background of the chest. The rash tends to fade out at about the level of the umbilicus. When rash *A* appears, the patient will uusually have been having medication and the question of dermatitis medicamentosa arises. If the rash is a dengue rash it will disappear in spite of the continued use of the drug in question. In short, there is nothing typical about the appearance of rash *A*, and it is easily confused with any other toxic rash. This rash is seen in about 35 percent of cases.

Rash *B* is quite different and though it is found in only about 20 percent of cases, it is so characteristic as to be an almost pathognomonic sign when present. Rash *B* rarely occurs before the fifth day, usually about the seventh day, and may occur as late as the tenth day after the patient has been discharged from the ward. This rash gives the appearance of a shower of petechiae, usually found on the sides of the foot over the first and fifth metatarsal bones. There may be only a few petechiae, but these are easily recognized if careful examination is made in a good light. The next day the petechial rash may spread over the whole foot and ankle, and extend up almost to the knee.

When the rash is extensive there may be a few petechiae on the thigh. These spots do not fade on pressure. Rarely these petechiae seem to become confluent, and the skin over the whole foot and ankle appears violaceous. The rash fades after 1 to 3 days and leaves no sign other than a brownish or purplish discoloration which may last a few days. This lesion is bilateral and symmetrical.

A similar lesion, though less extensive, occasionally appears over the wrist, but this rarely occurs unless the feet are also affected. This rash on the feet and ankles is not easily mistaken for anything else and seems to portend that the illness is ready to terminate and belongs to the clinical pattern under discussion. In some patients a blotchy erythematous rash appears over the feet and ankles; in these patients the petechiae are not seen. Occasionally small pinhead-size petechiae can be found scattered over the mucous membrane of the roof of the mouth. There is no pain associated with these lesions. Before the onset of this rash there may be several hours of distressing pruritus over the hands and feet. This would presage the rash, but at times the rash fails to appear and the itching stops. Itching is not always present.

6. *Laboratory findings.*—A leukopenia is usually present and may appear on the first day but more frequently it is seen after the first

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1. **Typical** puffy eyelids and redness of the skin seen in dengue.

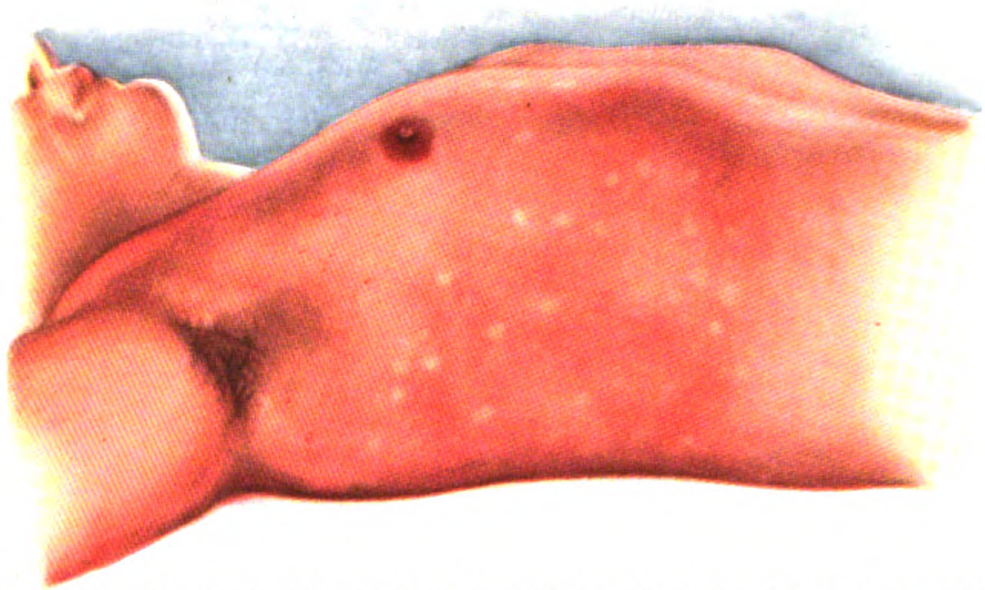


2. **Diffuse redness** of the palpebral conjunctiva and the normal appearance of **the** eyeball. A few dilated conjunctival vessels are seen.

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3. Toxic type "rash A" seen about the third to sixth day. There is a scarlet, diffuse redness of the chest and shoulders with islands of normal skin which give the appearance of white spots, half the size of a dime. This rash fades at about the level of the navel.



4. "Rash B." A petechial rash of this type is seen on both feet in dengue after the fifth day and as late as the tenth day.

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few days of the illness. A leukocyte count between 3,000 and 5,000 is the rule, but may be as low as 1,500. Monocytes up to 4 or 6 are found and many irritation cells and immature forms of neutrophils appear. The differential count may show a predominance of lymphocytes.

The urine is usually normal but may show albumin, at times more than would be expected from the febrile reaction. Albumin has been found in the urine for days after recovery from the febrile episode.

7. *Less frequent findings.*—These are findings which are seen less frequently but occur with sufficient regularity to be included as a part of this clinical pattern.

(*a*) *Cough.*—A hacking, nonproductive cough may be found at any stage of the illness and is associated with musical râles in the chest and occasionally slight wheezing, but there is no change in breath sounds or percussion note. X-ray examination of the lungs shows no evidence of disease. The cough requires no treatment. The eyes and nose are dry.

(*b*) *Neurologic signs.*—Various mild transitory paresthesias occur but do not require treatment. Restlessness and sleeplessness are a feature of the disease. The patient is often unable to sleep in spite of phenobarbital and codeine. Rarely the patient remains drowsy and apathetic throughout the illness.

(*c*) *Gastro-intestinal tract symptoms.*—Nausea and vomiting may occasionally be disturbing and require intravenous injections of dextrose and saline for relief. At times a vague pain and tenderness in the abdomen is present and, if on the right side, is sufficient to arouse suspicion of appendicitis.

(*d*) *Meningeal syndrome.*—Some patients have severe pain on movement and stiffness of the muscles of the neck and legs. This produces a clinical picture of stiff neck and yields a positive Kernig's sign. These patients are most uncomfortable and present an important diagnostic problem. If doubt as to the diagnosis exists, a lumbar puncture should be done. When the crisis of dengue occurs on the fifth or sixth day all the confusing signs will quickly disappear. Spinal puncture has not been done on the patients here but others have reported that the spinal fluid is normal in this disease.

(*e*) *General glandular enlargement.*—General enlargement of the lymph nodes is seen. In these individuals the posterior cervical, auricular, axillary, femoral, inguinal and epitrochlear nodes are palpable. This may cause confusion with infectious mononucleosis. No heterophil agglutinations have been attempted, but it is reported elsewhere that the heterophil is negative.

DIFFERENTIAL DIAGNOSIS

Early diagnosis of the infectious diseases is not easy. The early signs and symptoms previously described will sometimes enable one

to make a diagnosis of dengue on the day of onset of illness, but frequently diagnosis is impossible on the first day and may remain difficult. Dengue must be differentiated from infectious jaundice, German measles, scarlet fever, mononucleosis, malaria, bacillary dysentery, appendicitis, mumps, meningitis, influenza, virus pneumonia, and catarrhal fever, acute.

Infectious jaundice sometimes begins with a general malaise, red eyelids, cervical nodes, and fever. This can easily be mistaken for mild dengue. The appearance of the icterus or the presence of bile in the urine rules out the latter disease, but these findings may not appear for a week. The leukopenia, the blush of the skin, and the severe frontal headache, backache, and fiery-red conjunctivae, along with the typical rash, establish the diagnosis in dengue.

Mild dengue is easily confused with rubella. In both diseases there may be aching, low-grade fever, reddened eyes, palpable glands in the neck, and a leukopenia with irritation cells. The appearance of rash *B* will differentiate the two. Also malaise and headache are usually more severe and the leukopenia may be more marked in dengue. The absence of running nose or eyes in dengue further helps in its differentiation.

Rash *A* of dengue may be similar to the rash of scarlet fever. In dengue the throat is not so red as in scarlet fever and the rash is usually more marked on the chest and upper abdomen. The enlarged lymph nodes are confusing, but the leukopenia and the lack of "strawberry tongue" in dengue help to distinguish the two entities. The appearance of rash *B* will often establish the diagnosis of dengue. The bradycardia of dengue aids in making the diagnosis.

Mononucleosis will cause confusion, but recovery of the patient in 1 week and the absence of leukocytosis in dengue will usually establish the diagnosis. The two rashes are characteristic of dengue.

The onset of malaria may also simulate that of dengue. The leukocyte count of malaria is rarely as low as in dengue. The rashes and the subsequent course of the disease establish the diagnosis. Dengue is occasionally found in a person with malaria. While the finding of Plasmodia establishes the presence of malaria its does not rule out concurrent disease.

The first day of bacillary dysentery may cause confusion but the onset of diarrhea soon solves the differential problem.

The abdominal pain of dengue may simulate appendicitis, but the skin manifestations, general symptoms, rash, and leukopenia serve to differentiate the diseases.

The enlarged cervical nodes may give the appearance of mumps but this will not often be difficult to diagnose.

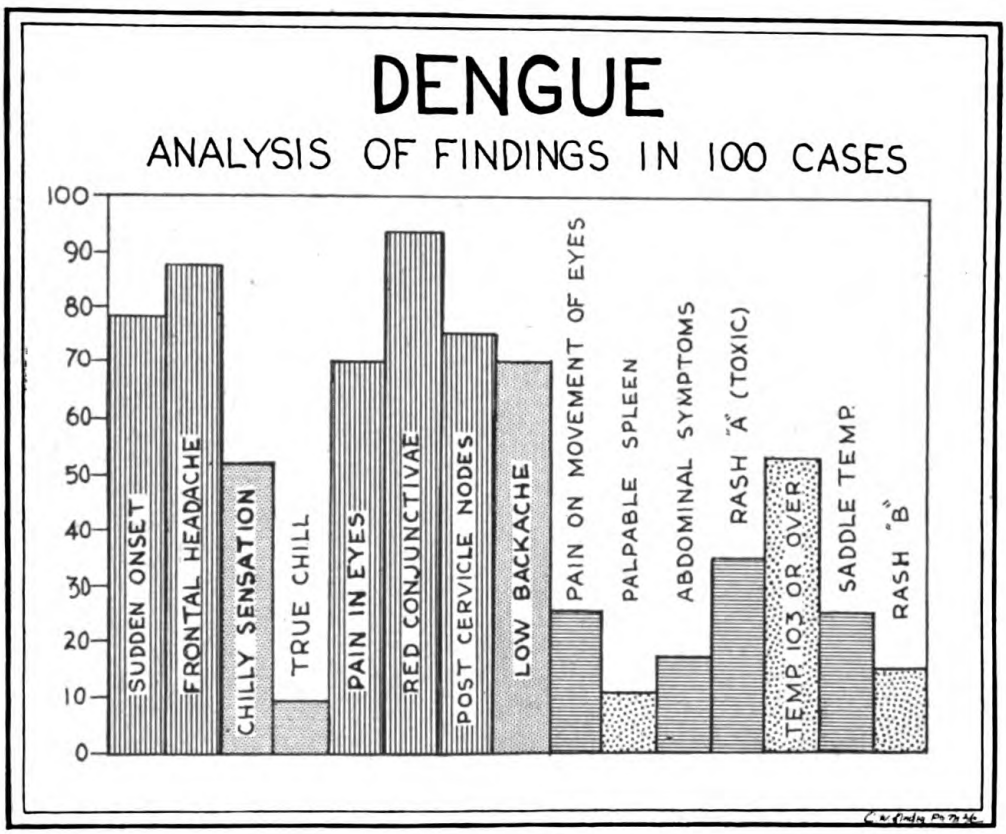
Influenza or virus pneumonia causes difficulty in differentiation.

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The symptoms of influenza may be quite similar to dengue, especially if catarrhal symptoms are lacking. The lymph nodes, the temperature curve, and the skin manifestations of dengue serve to differentiate the two diseases. X-ray examination of the lungs yields normal findings in dengue.

The meningeal type of syndrome occasionally seen in dengue suggests meningitis, but the skin rash, the slow pulse, and the leukopenia differentiate it. The muscle pains are more severe in dengue.

A mild dengue without any of the diagnostic signs such as rash and marked leukopenia cannot be diagnosed with any degree of confidence. The absence of catarrhal symptoms and the irritability serve



to differentiate it from acute catarrhal fever. Exposure to Aëdes aegypti mosquitoes, and the presence of an epidemic of similar cases, are necessary for the diagnosis of dengue.

TREATMENT

Treatment of dengue is entirely symptomatic. Reassurance, rest in bed, and sedatives are the most important therapeutic measures. Acetylsalicylic acid seems to control the discomfort but has the disadvantage of causing excessive sweating. Phenobarbital, 1½ grains, at bedtime is often not sufficient. Codeine, ½ grain, com-

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bined with acetylsalicylic acid, is required in most cases. Rarely is morphine required for relief of pain. Appetite is variable but often is much better than would be expected. Constipation is the rule but occasionally loose stools occur.

For several days after discharge there is a feeling of fatigue, and inability to carry on usual duty. This rarely lasts longer than a week. Despondency and irritability are often accompanying symptoms but almost never last longer than 2 weeks. Treatment other than rest is not required. Association of dengue with other diseases results in prolonging convalescence. The incubation period is as short as 5 days. There have been no proved recurrences observed in a period of 6 months.

SUMMARY

An acute febrile disease, which is found in an area where mosquitoes of the Aëdes aegypti species abound, has caused illness in one-fourth of the military command, and because of the large number of men ill at one time has shown itself to be of military importance.

The clinical pattern of this disease is described from observations made on some 300 patients.

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ABSORPTION AND EXCRETION OF PENICILLIN

Intravenous injection of penicillin results in a high initial concentration in the blood plasma which is followed by an abrupt fall. Traces of penicillin are found in the blood for one-half hour to over three hours after the injection, the length of time depending on the amount administered. The average excretion after an intravenous injection is about 60 percent of the administered dose.

Penicillin is slowly absorbed after subcutaneous injections and slowly excreted in the urine. In contrast, after intramuscular injection, it is rapidly absorbed and rapidly excreted. Absorption from the body cavities is delayed, as evidenced by slow excretion of penicillin by the kidneys.

Absorption from the duodenum is rapid following enteral administration and slow following oral and rectal doses. The amount excreted in the urine following oral, intraduodenal, and rectal administration is small. In the presence of renal failure penicillin is slowly excreted resulting in high blood concentration after intravenous injections. Human saliva, bile and succus entericus do not inactivate bile, but gastric juice destroys it rapidly, apparently due to its acidity.—DAVISON, F. A.: Synopsis of Materia Medica, Toxicology, and Pharmacology. 3d edition. The C. V. Mosby Co., St. Louis, Mo., 1944. pp. 664–665.

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EOSINOPHILIA IN THE SOUTH PACIFIC

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Lieutenant Commander (MC) U. S. N. R.

Each patient admitted to this base hospital received at least one complete blood count which included a Schilling differential count. During a 16½-month period a total of 17,502 differential counts was made. For the basis of this study any patient whose smear showed 10 percent or more of eosinophils was considered as having a definite eosinophilia. There were 987 such patients who were classified as follows:

Percent eosinophils	*Patients*
10 to 19	816
20 to 29	106
30 to 39	26
40 to 49	23
50 to 59	9
60 to 69	4
70 to 74	3

Table 1 shows the number of patients admitted by months with an eosinophilia, and the services to which they were attached. Graph 1 shows the percentage of admissions for each service by months.

TABLE 1.—*Number of patients with eosinophilia*

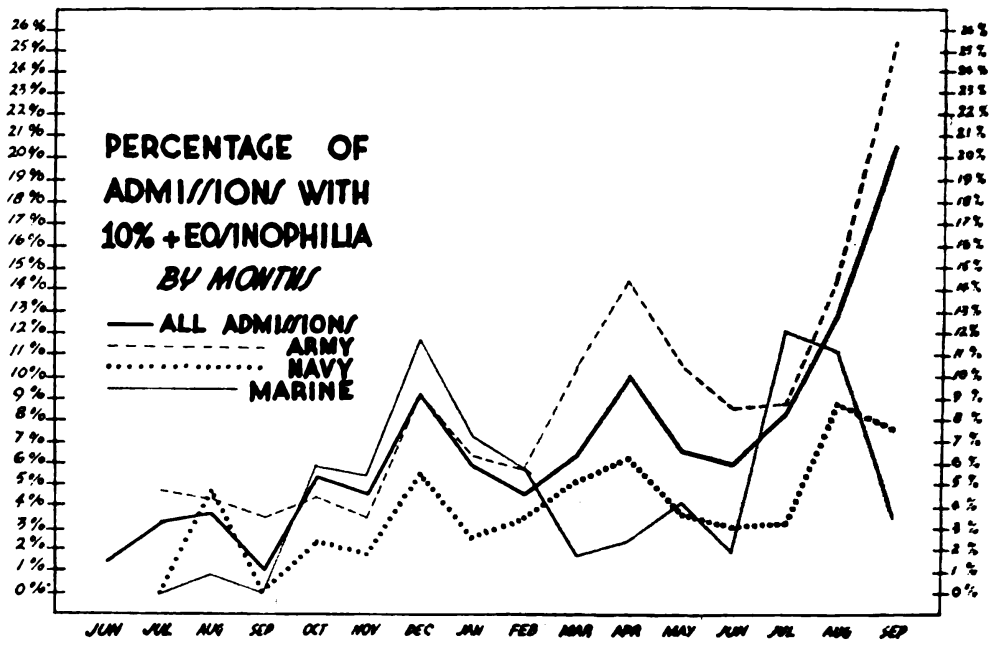
Month	Patients with eosinophilia	Army patients with eosinophilia	Navy patients with eosinophilia	Marine patients with eosinophilia
1942—June	7			
July	16	14	0	0
August	14	9	3	1
September	6	6	0	0
October	45	10	3	27
November	56	15	4	32
December	65	30	7	28
1943—January	78	51	4	23
February	27	10	9	8
March	48	31	14	3
April	105	83	18	4
May	88	58	22	8
June	82	65	15	2
July	91	72	7	8
August	130	102	20	7
September	129	117	10	1
Total	987	673	136	152

An analysis of the graph shows that there has been an increase in the percentage of all hospital admissions showing eosinophilia,

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from 1.4 percent in June 1942 to 20.3 percent in September 1943. By a closer examination of the hospital records, it was determined that the dips in the curves represent the movements of new forces into the Solomon Islands and the subsequent admissions of members of these forces to the hospital.

The first Marine patients from the Solomon Islands were received by this hospital on 18 August 1942. The Marines, new to this area, brought down the percentage of eosinophilia for September 1942, but there was a sharp rise in October, which is more noticeable in the curve of Marine admissions. The first Army patients from the Solomon Islands were admitted on 22 October 1942. During December all curves hit a high peak. New Army units entered the area late



in December 1942 and began to appear as hospital patients in January 1943.

Members of the Marine Raider Battalions rapidly disappeared from the hospital admissions because they were taken out of the area and replaced by Army units. This is reflected in the corresponding Marine and Army curves. The New Georgia campaign began 30 June 1943 with Marine Raider Battalions and Army units, the majority of which had seen action in the Guadalcanal area. Their admissions as patients caused an upward trend of all curves.

It will be noted that the Navy curve is similar to the Army curve except at a much lower level. This can be explained by the fact that almost all of the eosinophilia in Navy personnel occurred in the members of the Construction Battalions, those serving with the Marines and those attached to advanced shore-based units. The

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movements of these units correspond with the movements of the Army groups. The majority of the Army patients with an eosinophilia belonged to infantry troops, and the majority of the Marine patients with an eosinophilia belonged to the Raider Battalions.

In order to show the great increase in the percentage of admissions of patients with eosinophilia from the Solomon Islands area, the percentage of admissions from three infantry groups from that area was compared with that of a local island infantry unit as follows:

	Local (percent)	*Solomon Islands (percent)*
July 1942	4.6	----
December 1942	7.1	----
January 1943	8.2	4.3
April 1943	5.1	21.2
August 1943	---	19.8
September 1943	---	34.7

The local island infantry group came directly from the United States to this island in May 1942, while the other three infantry groups were stationed in the Hawaiian Islands from 3 months to 2 years prior to entering the Guadalcanal area in December 1942. Infantry troops stationed in the Russell Islands prior to entering the New Georgia campaign showed a lower percentage of eosinophilia on admission than did those troops which had been stationed in the Guadalcanal area.

The number of patients who showed eosinophilia and the percentage height reached made this a diagnostic problem. It was suspected from the beginning that helminths might be responsible for this increase in eosinophils and a large number of stools was examined. A few patients showed hookworm ova in their feces, but this was out of proportion to the number of eosinophilia patients admitted. Extensive and complete stool surveys could not be made at that time because of limited microscopes and personnel.

Beginning in August 1943, the policy of the hospital was changed so that patients were kept for a longer period before being evacuated to other hospitals. It was decided that more emphasis should be placed on stool examinations. Separate laboratory charts were kept on all patients and other charts were made on all eosinophilia patients. From this information a more accurate picture was obtained.

During the month of August there were 139 patients who showed during their course in the hospital an eosinophil count of 10 percent or above. Of these 139 patients, 108 showed eosinophilia on admission while 31 showed it on subsequent examinations. The ma-

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jority of these 31 patients did not show eosinophilia until 2 to 4 weeks after admission.

Of the 139 patients who showed eosinophilia, 71 or slightly more than half had stool examinations while in this hospital. Of the 71 patients who had stool examinations 30, or 42.3 percent, showed helminths in their feces, 28 ova of hookworm, 1 rhabditiform larvae of Strongyloides stercoralis, and 1 both larvae of Strongyloides stercoralis and hookworm ova. Of the 29 patients with positive hookworm findings 15, or 51.79 percent, had one or more negative examinations before the ova were found. There were 3 patients who showed hookworm ova in their stools who failed to show an eosinophilia of 10 percent or above. Two of these showed 8 percent and one showed 6 percent eosinophils.

During the period from 15 May 1942 through 30 September 1943 there were 16 patients who showed an eosinophil count above 50 percent on one or more occasions. Of these 16 patients, 8 showed hookworm ova in their stools, 1 larvae of Strongyloides stercoralis and 1 both larvae of Strongyloides stercoralis and hookworm ova. Five patients did not have stool examinations during their stay in the hospital, and 1 had three stool examinations with negative results shortly after admission and remained in the hospital only 11 days.

From 15 May 1942 through 31 July 1943 there were 35 cases in which hookworm ova were found in the stools. From 1 August 1943 through 30 September 1943, 58 additional cases were found.

It would appear from the above data that eosinophilia is occurring in an increasing number of the armed forces in the South Pacific area. This is particularly marked in the Army infantry troops and the Marine Raider Battalions in the Solomon Islands area. Probably a large part of it is explained by hookworm infestation. The survey in August indicates that hookworm infestation can be demonstrated in a higher proportion of patients with eosinophilia if the patients are followed longer. In some of the cases the ova were not found until 2 to 6 weeks after admission. In still other instances eosinophilia did not develop until 2 to 4 weeks after admission. This would seem to indicate that we were dealing with early hookworm disease, at a stage when eosinophilia was present but often before ova could be found in the stools.

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DENTAL PLANNING AFLOAT AND ASHORE

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Captain (DC) U. S. N.
and
CLIFFORD E. ALLEN
Commander (DC) U. S. N.

In planning the physical layout of dental facilities for Naval use one is confronted with problems which are peculiar to Naval dentistry. This is essentially true regardless of whether the facility being planned is to be located aboard ship or ashore. For all practical purposes the dental operating room aboard ship is found only in vessels of the Navy. Also, nowhere ashore except in the Army, do we find such large concentrations of dentists working together as a team under the direction of a senior dental officer.

This very concentration of dental effort leads to economies in administration, matériel and function which are not possible to achieve in smaller units, and which economies are reflected in dental planning. It can be readily seen that whereas an x-ray unit is essential in satisfactorily equipping a single dental operating room, it by no means follows that ten such units will be required to equip a dental facility which includes ten operating rooms. Moreover this concentration of dental officers permits the assignment of those officers who are especially qualified in the several dental specialties to duties where the greatest return may be realized from their effort. This in turn requires the functional juxtaposition of certain components of the facility being planned.

Another point to be considered in dental planning for the Navy is the fact that here the dental service is more essentially an integral part of a health service than is the case in civil practice. This is especially true in planning the dental layout for hospitals and hospital ships although it does pertain to other activities ashore and to combat vessels as well.

In planning dental installations in new construction ashore we rarely encounter the necessity of treating each space as a separate problem. Usually a standard schematic arrangement can be adapted to the allotted space in new building. Not infrequently the building itself is planned solely for the purpose of housing the dental activity. However certain architectural and engineering standards and the

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desirability of maintaining harmonious fenestration may at times cause a deviation from standard plans.

This forced deviation from the ideal is to be expected in remodeling of buildings where no provisions were made in the original plans for dental spaces, in ships undergoing conversion to Naval use, and to an extent in the new construction of Naval vessels. In the latter instance the placement of knees, stiffeners, stanchions and other structural components, which are essential to the military features of the type of vessel being planned, may require a rearrangement or at times complete relocation of the dental facility. However a standard schematic arrangement of furniture and equipment in the dental operating room should be adhered to as closely as possible.

All too frequently in the past, in planning dental spaces, consideration has been given only to the required number of dental operating rooms. Plans for the inclusion of those accessories and appurtenances which add so materially to the efficient operation of a dental facility have been either neglected or entirely omitted. Experience teaches the importance of making a detailed and comprehensive study of the requirement and limitation of each situation before working plans are drawn or construction is started.

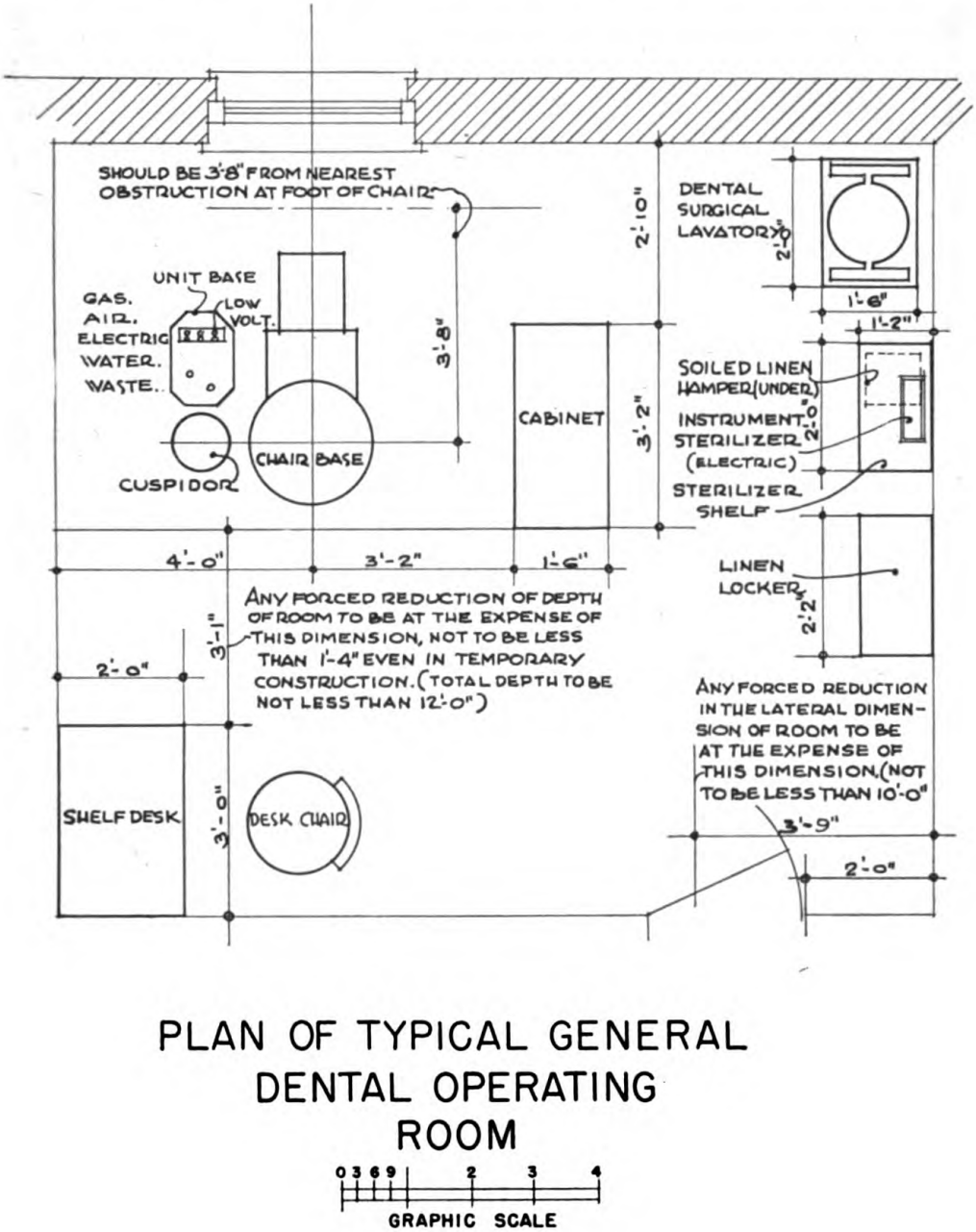
The suggestions and plans presented herein have not been arbitrarily conceived. They are the result of a compilation of the opinion of a large number of dental officers, officers of the Civil Engineer Corps and of line officers who have been identified with the construction and repair of Naval vessels. The opinions of these officers have been widely divergent as to the space required for the installation of a single dental operating room, but are fairly in accord as to the detailed schematic plans for the arrangement of equipment.

Although the variables which may be encountered in planning larger dental facilities are myriad, generally speaking it may be said that the unit of dental planning afloat and ashore is the schematic layout of the single dental operating room.

To provide utility in a dental operating room, unity in the general arrangement of dental equipment must be emphasized. In order to gain unity and utility a satisfactory room or space must be provided to receive the equipment. Figure 1 illustrates in detail a typical dental operating room. Its dimensions are 12 feet in length and 13 feet, 9 inches in width. These are the maximum dimensions desired for permanent shore activities. The minimum acceptable dimensions for a dental operating room without loss of function or efficiency are 12 feet in length and 10 feet in width. These dimensions will necessitate a slight change in the arrangement or location of equipment and services to the right of the chair. The chair should face the out-

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side wall or windows ashore, or outboard bulkhead aboard ship. The detailed plan, as shown in figure 1, depicts a systematic stage set for a dental operation, accommodating operator, assistants and pa-



PLAN OF TYPICAL GENERAL DENTAL OPERATING ROOM

FIGURE 1.

tient, facilitating the handling of patients, providing privacy, and conserving floor space.

All dental operating rooms ashore should be outside rooms with one full-size single window 5 to 6 feet in width, or full-size double windows, each 2½ feet to 3 feet in width, with mullion placed between.

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Windows must permit easy opening and adjusting to allow for natural ventilation. The width of the sections of the windows should be considered. Multiple-pane windows are objectionable and do not permit the free passage of natural light. The question may arise of the need of natural light since artificial light is used almost entirely in dental operations. The modern concept is that natural light is not essential for balanced illumination but that it should be utilized as a supplementary light. It must be emphasized that color quality in light is a very relative thing. The reason one goes to a window for color matching or color appraisal is not merely the better quality of daylight but its tremendously increased intensity.

There are two problems to consider in dental operating room lighting, first to illuminate the inside of the mouth, the other to illuminate the operating area outside. Each area requires a separate set of fixtures for its illumination.

Lighting of from 150 to 1,000 foot-candles, without change in the color quality of the light, should be available for intra-oral lighting in order that at least 250 foot-candles can be delivered deep into the oral cavity, this permitting at least 50 foot-lamberts[1] of light to reach the eye.

The lights in the dental operating room for general vision should furnish at least 40 to 50 foot-candles around the chair, 25 to 30 foot-candles over the dental cabinet, and 10 foot-candles in all other parts of the room. The requirements for general vision lighting as described above can be attained by the correct distribution of baffled nonglare lights.

Wherever possible wall partitions should be built solid and extend to the ceiling. All doors should be of the solid paneled type with overhead adjustable transom for room ventilation. The walls should have a suitable number of semi-indirect ventilators for the circulation of air. The use of an acoustic material for the ceiling will help cut down reflected sounds.

The color treatment of floor, wall, and ceiling should be the same. This provides for continuity and is a necessary procedure where rooms adjoin each other. In painting outside rooms it is necessary to take into consideration the exposure to light, the size of the room and windows, the intensity of light as influenced by outside obstructions, and the color of the dental equipment, which is a Navy standard green. The right color to select is either a light delicate tint of green or a mixture of silvery gray. In the three planes of a room, the floor, the walls, and the ceiling, the darkest tone of color should be on the floor. The walls should be of an intermediate value and the ceiling

[1] Foot-lamberts = the standard unit measurement of reflected light, the light that reaches the eyes.

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in general should be the lightest. This scheme will produce a positive color tone balance with little negative reaction. Color also has an effect on room size. If floors and walls are harmonious and about the same color tonality, the room will seem larger. All wood trim, window frames, door frames, and baseboards should be finished in the same color as the walls but of a darker shade in a semilustre paint. This dull gloss surface is easily kept clean and relieves any possible monotony of color. Each side of the door should be the same color as the wood trim of the room it faces when the door is closed.

This correct color balance of all surfaces without the reflection of high lights from these nonglazed, nonreflecting surfaces has a direct relation to visual fatigue, which is thereby greatly lessened.

The floor covering will depend on the type of construction and underflooring. To choose a suitable material, the characteristics of all materials must be considered, their sanitary value, durability, factors of security, comfort, and facility of repair. The materials of choice are wood, including strip flooring, plank, and block; tiling of asphalt, ceramic, quarry, and cork; roll material, such as sheets, linoleum, and cork; and composition materials of terrazzo, magnesite, and concrete. Availability of material at the present time will determine what may be used. With wartime quick construction of semipermanent buildings, an all-over dark colored linoleum without pattern design will help carry out the color harmony of the dental operating room.

Furniture and dental equipment as shown in figure 1 are systematically arranged as follows: A shelf desk 3 feet in length and 2 feet in width is placed in the back left-hand corner of each room. This desk has one deep drawer which is considered large enough to provide for the stowage of appointment books, dental abstracts, file records, pens, pencils, stationery, etc. The center of the dental chair is located 4 feet from the wall to its left and 3 feet, 8 inches from the nearest obstruction in front of the chair. The left side of the base of the dental unit is spotted 1 foot, 10 inches from the wall to its left and the front part of the base is located 2 feet, 7 inches from the forward wall. This places the dental unit to the left and slightly forward of the dental chair. A foot-controlled lavatory bowl is placed in the forward right-hand corner of the room. The cabinet serving as a soiled linen hamper and sterilizer shelf, and the clean linen cabinet are located against the right-hand wall. The dental instrument cabinet is located to the right of the chair and can be placed at any distance or position the operator may choose. The detailed arrangement of the essential furniture and equipment as shown provides unity, with accessibility enough to permit operator and assistant to work freely.

In planning the dental facility afloat an effort is usually made to

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locate this facility on the same deck and if possible contiguous with other hospital spaces. This has proved to be desirable in the past, particularly on smaller vessels where the dental x-ray equipment and the services of the dental officer have been utilized in the making of a wide range of roentgenograms for general diagnostic purposes. Although portable x-ray equipment is found aboard all hospital ships of our Navy today and also in many combat vessels, the dental x-ray continues to serve in this dual capacity. Other advantages which accrue to this arrangement are the ease with which patients may be transferred from the dental operating room to the ward and vice versa, the rapidity and facility with which the dental officer may utilize the services of the bacteriologic laboratory, the dispensary, the general anesthetist, etc., and the possible installation of a single darkroom for the use of the entire medical department of the ship.

The saving of the small amount of space required for the installation of a darkroom will undoubtedly be considered a minimal advantage by many persons. However the monotonous regularity with which the dental planner faces a restricted area in which he must place a given amount of nonelastic material makes the saving of a few square feet of deck space an important matter.

This is particularly true when one considers the fact that all space allotted aboard ship is necessarily restricted. The problem is further complicated by the increased complement which is found necessary aboard all types of vessels to meet the demands of modern warfare. In turn this very increase in complement makes for an additional demand on the dental service of the ship.

From th foregoing it would seem that something of a vicious circle is established and to an extent this is true; however, by stringent economies in the use of allotted space a satisfactory arrangement can usually be worked out.

Despite the limitations of space there are certain requirements which are highly desirable and which if possible should be included in the completed plan. Among these is the provision of some space for patients awaiting sick call. This space should be so located that the patient and operator are not visible to those who are waiting.

The type of ship for which plans are being drawn will largely determine the size and character of the dental layout. Thus for modern battleships we may plan for as many as three operating units and for such additional radiographic, prophylactic and other facilities as the limitation of space will permit.

In planning the dental suite aboard a hospital ship provision must be made for the installation of prosthetic facilities and for the fitting out of one of the operating rooms as an oral surgery.

Despite the ever pressing limitation of space aboard ship there is a minimum optimal space in which dental operations can be carried out.

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This space is exclusive of that required for office furniture, etc. It must be wide enough to accommodate the equipment in the dental operating room with the operator in position beside the chair, long enough to permit the patient to be placed in the recumbent position with the operator at the head of the chair and at the same time it must permit free passage of the dental assistant around both the chair and operator. It is possible to accomplish this in a space 8½ feet wide by 10 feet in length and at the same time allow room for the general anesthetist. Although it is possible for a dental operator to function in a space smaller than that described, it is highly desirable that more space be allotted each operating unit, particularly in its lateral dimension. This statement is substantiated by the fact that several experienced dental officers have gone on record as advocating a dental operating room of approximately 14 feet in width for use ashore where space is less at a premium than it is aboard ship.

Figure 2 illustrates a three-chair dental facility currently installed aboard a modern battleship. It is generally satisfactory and would be considered excellent if the over-all dimensions permitted a minimum width of 8½ feet and a minimum depth of 12 feet for each of the operating spaces. The over-all deck dimension of the compartment provided for this facility is 24 feet fore and aft by approximately 10¼ feet athwartship. It is divided into three dental operating rooms and the senior dental officer's office, each space having a dimension of 8 feet by 10¼ feet separated by a partial bulkhead 6 feet high and 5¾ feet long.

One entrance is provided from the passageway of the ship to the dental clinic. Sufficient room is provided between each dental operating space and the inboard bulkhead to allow for the free passage of patients and operating personnel. A small one-drawer shelf desk may be installed at the proper height for each dental operating space on the inboard bulkhead if desired.

The senior dental officer's office is furnished with a typewriter desk, two office chairs, desk light, book rack, and ship's service telephone. The built-in dental utility cabinet depicted and explained in figure 3 which follows, is shown installed inboard of the senior dental officer's office in figure 2.

The operating room adjacent to the senior dental officer's office is furnished with standard dental x-ray, chair, unit, cabinet, foot-operated lavatory bowl, work shelf, towel rod, sterilizer shelf, sterilizer, soap dish, soap dish holder, tumbler, tumbler holder, waste receptacle, and lights for intra-oral illumination and general room illumination. The two other operating rooms are similarly equipped except for the x-ray unit.

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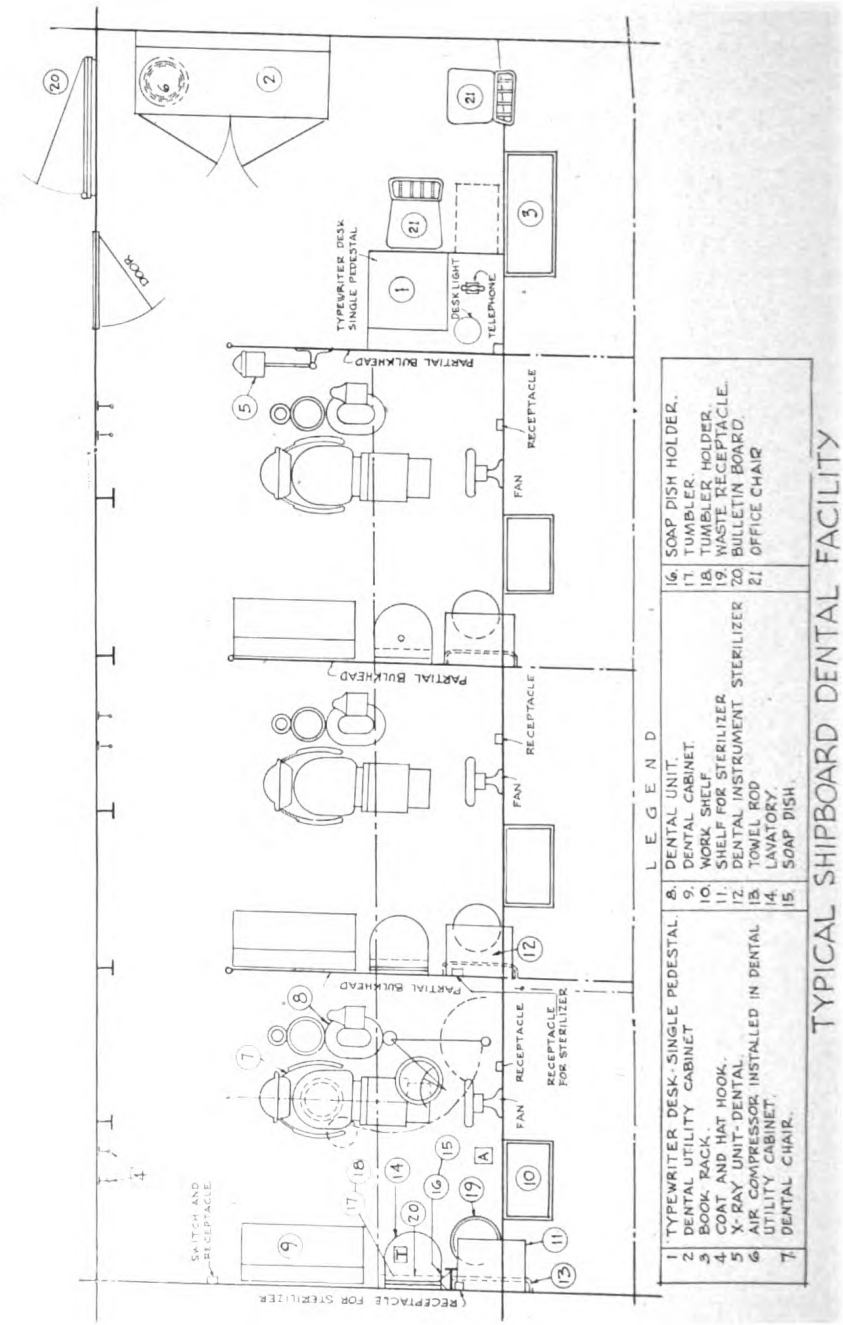


FIGURE 2.

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In order to aid in the conservation of space in the dental operating room, a general dental utility cabinet, figure 3, has been designed. The design has been accepted as a standard and at least one such utility cabinet should be installed in each ship having dental facilities. This cabinet occupies 6¾ square feet of deck space, stands 7 feet, 4¾ inches in height and is 21 inches deep. Any reduction in this height due to the distance between decks or overhead obstruction is made at the expense of the upper lockers. The cabinet is built according to specifications for the construction of furniture and lockers of steel and aluminum for shipboard use. The weight of the cabinet with sub-base is approximately 275 pounds.

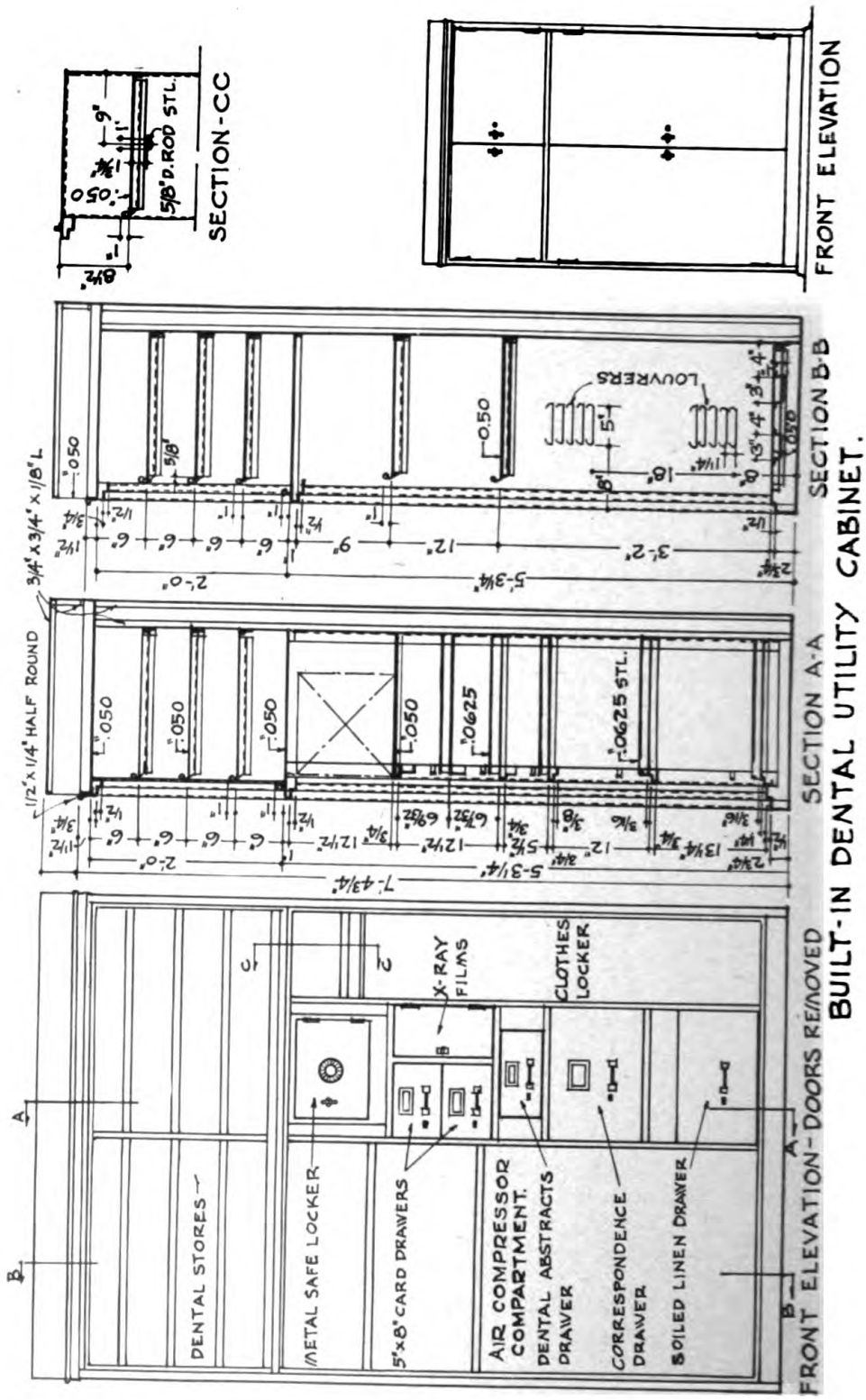
The front of the cabinet has four paneled doors hinged to open from the center forward. The doors are secured at the center by means of latches easily manipulated by large handles on the outside. The two upper doors open into a locker with removable adjustable shelves for the storage of dental supplies. The two lower doors open into a compartment containing a space with adjustable shelves for the storage of clean linen; below this space is a locker for the reception of an air compressor. The side of the cabinet which contains the air compressor is louvered to permit the free circulation of air within the cabinet proper. To the right of the air compressor installation is a drawer for the reception of soiled linen. Above this drawer are additional drawers for correspondence, dental abstracts and record cards, a compartment for x-ray film storage and a combination-controlled safe for stowing poisons, narcotics and precious metals. To the right of these spaces is a clothes locker for use of the personnel attached to the dental office.

The dental supply cabinet, clean linen locker, soiled linen locker, air compressor, combination safe, x-ray film storage box, filing and correspondence cabinets, and individual clothes locker that were previously installed in a scattered arrangement around the dental office, taking up a great deal of needed deck space, have been assembled and housed compactly in one single built-in dental utility cabinet. The location of the cabinet in a suitable part of the room greatly increases the working efficiency of the office. The space conserved allows for a more harmonious arrangement of equipment. It aids the composition and continuity of a well balanced streamlined office.

There are certain fundamentals which must be taken into consideration in planning the dental facility ashore. They are similar to those which govern the planning of dental installations afloat but are broader in their general aspect. Greater latitude in the use of space is permissible, and is desirable within reasonable limitations.

In selecting the site for those large dental activities which are to be housed in their own buildings consideration should be given to the size

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BUILT-IN DENTAL UTILITY CABINET.

FIGURE 3.

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of the plot or plots of ground available to receive the structure, the proximity to activities where there is a great deal of noise or other undesirable features, the distance of the proposed site from the location of the personnel to be served, and the availability of gas, hot water, electricity, and transportation.

In locating the dental clinic which is to be an integral part of a hospital or dispensary, consideration must be given to its relation to the other professional services of the institution of which it is to be a part.

In all cases we must take cognizance of the type of equipment required and at times, particularly in time of war, the amount of equipment that is available, as well as the plan of installation which will result in the most efficient dental service.

In connection with the availability of dental equipment it is interesting to note the ease with which the Dental Corps of the Navy, when faced with a shortage of certain items of equipment, adapted itself to the two-shift idea of dental service. By means of this procedure, in certain activities one group of dental officers worked from 0600 to 1200 and a second group from 1200 to 1800, both groups using the same equipment. While undesirable as standard practice this action served to nullify a situation which, while transitory, was serious.

The size and character of the dental activity being planned should be based upon the number of persons to whom dental service is to be rendered and the type of dental service which will be undertaken at the specific activity. It must be borne in mind, however, that the anticipated patient load will not necessarily be in direct ratio to the current population of the station for which dental service is being planned. For example, the rapid turnover of the population of a training station requires a proportionately greater dental facility than would be required in an activity where the personnel was more static.

The type of dental service to be rendered is of great importance in planning and is largely determined by the station to be supported. Thus in training stations the dental facility is planned primarily for operative procedure and for exodontia; whereas in certain other stations the establishment of a large, smoothly functioning prósthetic laboratory is of primary interest. In the hospital as in the hospital ship, and to an even greater extent, provision must be made for an oral surgery. Again, we find the station where the attached personnel is more or less evenly distributed as to age groups, and where the turnover of population is fairly regular. Here we more closely approach the civil standard in that the dental requirement is not predominately for a particular type of service.

The size of Naval dental facilities ashore range from the single chair unit where all professional activities are carried out in the same

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operating room to those very much larger activities which include provisions for the practice of most of the dental specialties. These larger dental installations comprise up to 40 operating rooms supported by an examining room, x-ray room, oral surgery, a prosthetic laboratory, rooms set aside for periodontia and oral hygiene, administrative offices and various other components. It is from these larger dental facilities that the greatest average per capita return is realized from the efforts of the dental officer.

Furthermore grouping of certain components is particularly desirable in large dental activities. Thus we find that the reception room, the room containing the appointment desk, the record office, the senior dental officer's administrative office and the store and issue rooms may be expeditiously grouped together in what is aptly termed the administrative suite.

The reception room should be adjacent to the entrance to the clinic. The appointment desk should be located in a room adjoining the reception room and when possible should open into it by means of a window located over a desk or counter at which appointments are made. If necessary the appointment desk may be located in the record office, otherwise it is desirable to have it located in a room or alcove continuous with the latter office. The administrative office of the senior dental officer is preferably situated next to the record office and frequently communicates with it by means of a door. If possible the store and issue rooms should be placed contiguous with or in close proximity to the administrative office. It is desirable that the storeroom contain a built-in strong room for storing precious metals, alcohol, and narcotics.

In large dental clinics it is possible for the dental diagnostician to function as a full time specialist. In these large clinics the one or more examining rooms should be located adjacent to the waiting room. Here the incoming patients are examined and as indicated, dental charts are either prepared initially or corrected to indicate the current condition. If possible a transillumination booth and facilities for the microscopic examination of bacterial smears should be adjacent to the examining room.

The roentgenographic room together with its darkroom may advantageously be located between the examining room and the oral surgery. Quite probably the greater demand for roentgenograms will be made by the diagnostician in his routine examinations, but we must not lose sight of the fact that at times it is desirable in the midst of surgical procedure to check the progress made by means of the x-ray. For this reason the oral surgery should communicate directly with the x-ray room. Also and usually on the side opposite the x-ray room, the oral surgery should communicate with the recovery room. When no other

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provision is made, the recovery room may serve in a dual capacity as the officer-of-the-day's sleeping quarters at those stations where a night watch is maintained.

The dental developing unit as shown in figure 4 can be of wood or metal construction with counter top and sink of soapstone, and includes a dental developing tank. In general the construction of the unit is as specified for cabinets, cases and tables. A recess for film hangers is

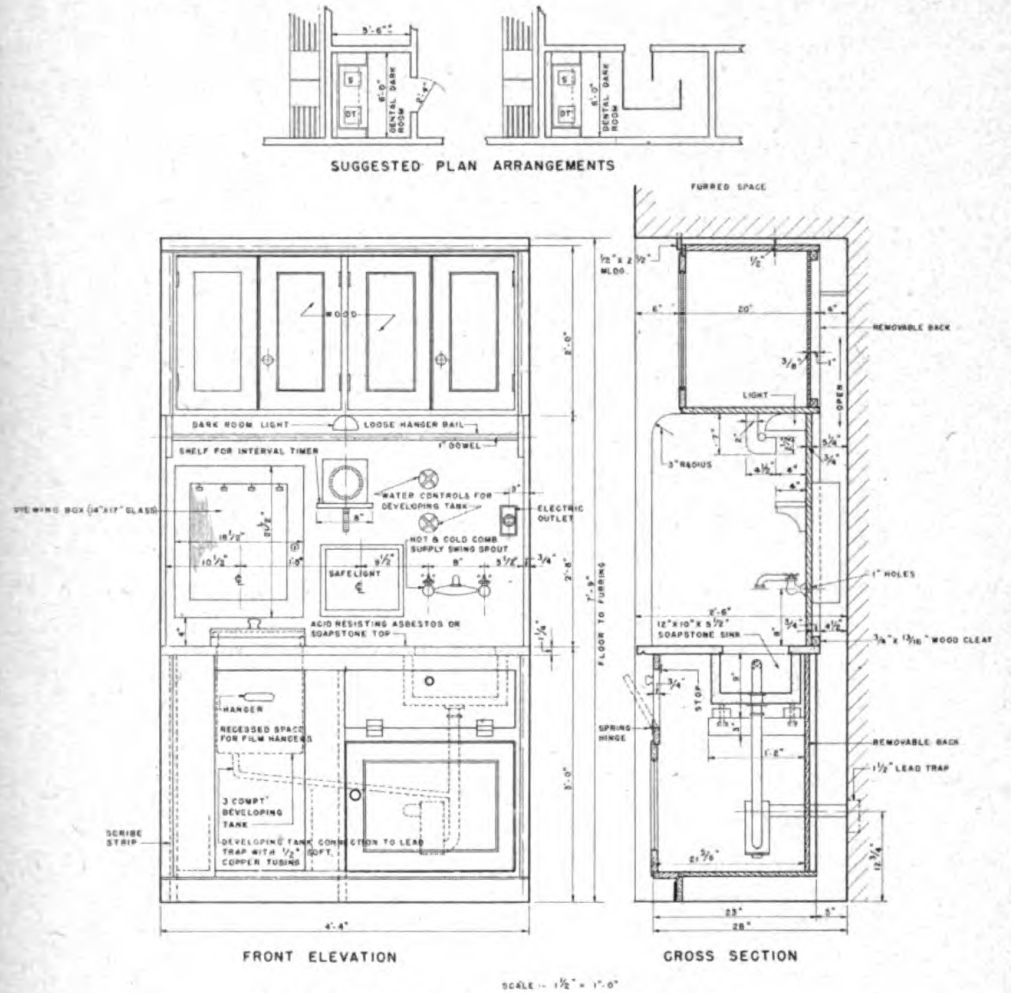


FIGURE 4.

located below the counter. The sides and back of the unit above the counter are of metal or wood and of construction integral with the cabinet above; cutouts and holes to receive the services and equipment specified are provided. A removable rod 1 inch in diameter, and supported on sockets or brackets is also provided. The dental developing tank is built into the counter approximately as shown. The tank has three compartments which have the following respective capacities: Developing solution, 1 gallon; fixing solution, 1 gallon; and wash water, 4 gallons. The developing tank has connections for hot and cold water, and a waste which is connected to the bottom of the washing

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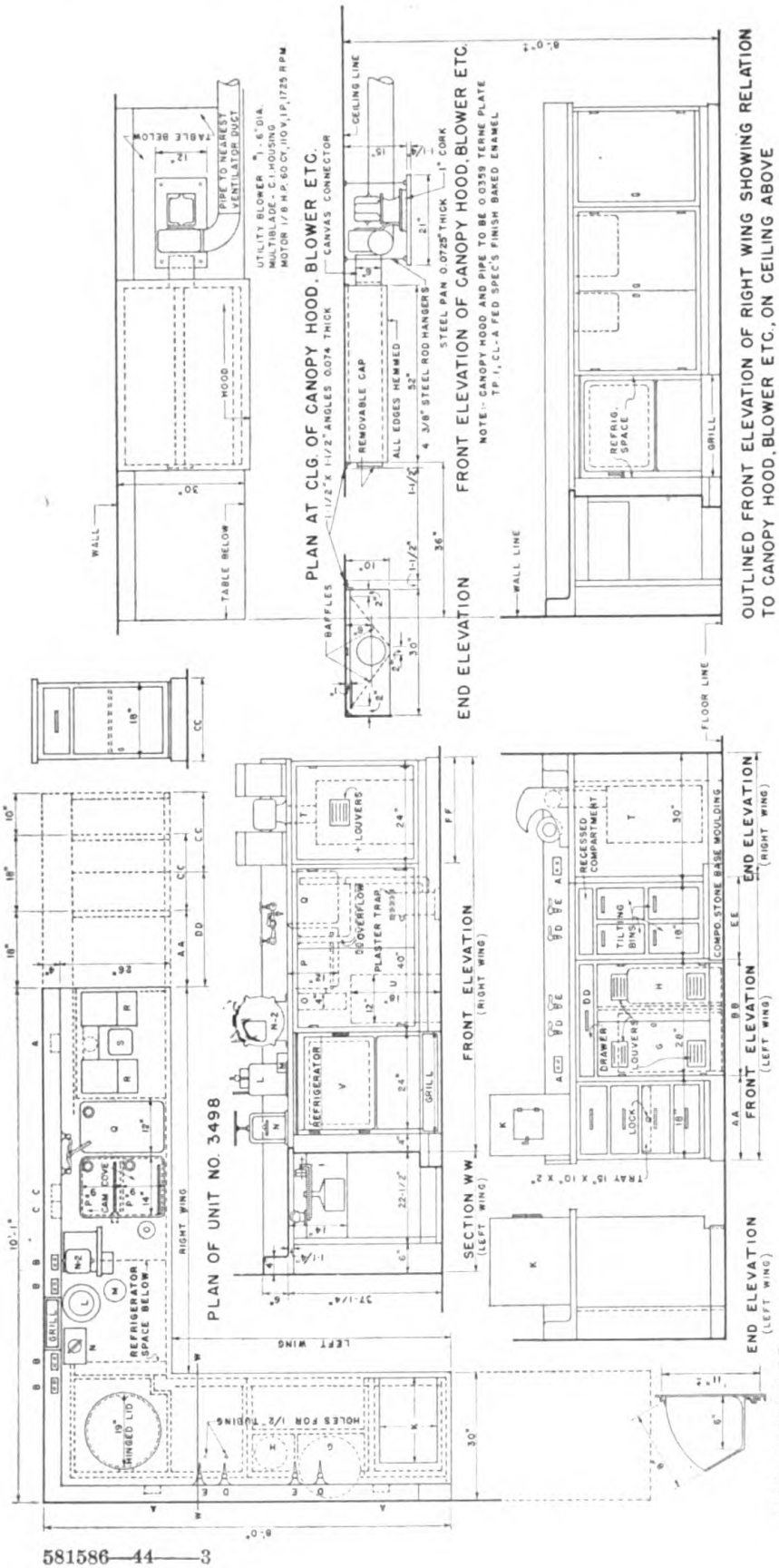
space; a ¾-inch diameter overflow port is connected to the waste line located on the back wall of the washing compartment so as to maintain the proper level of the wash water.

The partitions between the compartments containing developing solution, fixing solution, and wash water respectively, are each provided with a removable plug which permits the draining of solutions into the washing compartment. Controls for the water supply to the tank are provided approximately as indicated. Control of the waste from the tank is by a valve located below the bottom of the tank. The valve is located in an easily accessible position and is provided with a handle which projects slightly in front of the tank. Sinks and counter tops conform to the standard specified requirements for soapstone sinks and drain boards. A 1½-inch hole in the left-hand corner near the back of the bottom of the sink provides a means for the waste connection. The waste has a removable type standing overflow 4 inches high. A combination hot and cold mixing faucet is located about 8 inches above the counter top. Apparatus for cooling water, developing solution, and fixing solution is necessary in warm weather to process exposed x-ray films properly.

The film illuminator indicated as viewing panel is the size required to accommodate 14-inch by 17-inch x-ray film. The illuminator is provided with 2 fluorescent tubes, each having a capacity of not less than 15 watts. The illuminator is installed with the face flush with the wall surface. Film clips, switch, and complete wiring are provided. A safe light with switch and complete wiring is installed with the face flush with the wall surface. A shelf approximately 4 inches by 6 inches of metal or wood material, and with center bracket, is provided at the location indicated. Provision for outlets and receptacles is as follows: A duplex electric outlet is installed flush with the wall surface and located with its center 18 inches above the top of the counter and about 3 inches from the wall at the right-hand side of the counter. A porcelain receptacle, with pull chain, for darkroom light is located on the bottom of the ceiling cabinet, at the center approximately as shown.

The darkroom should be situated next to the x-ray room and entered from it through the labyrinth. If a large room with labyrinth is used, it is well to have a louvered safety light door communicating with the main corridor, thus providing better ventilation and allowing for the convenient passage of equipment in and out of the room. Air circulation is by fans, louvered doors, and semi-indirect ventilators placed in the walls and ceiling. White is a desirable color to paint the interior and will obscure any light-ray leaks into the room from the outside better than a darker color.

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PLANS, ELEVATIONS AND SECTIONS OF DENTAL UNIT NUMBER 3498

FIGURE 5.

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The reason for this unit's successful use is that it has been specifically designed to meet the full requirements of a darkroom, to fit into a limited space and function efficiently. If a larger space is available the unit may be placed in one end of the room and a maze or labyrinth entrance provided at the other end, making the room directly accessible without opening and closing safety light doors or light-proof doors.

It is highly desirable that provision be made for an adequate number of prophylactic units. There is a considerable divergence of opinion as to whether these units should be located in separate rooms as are the operating units or whether they should be grouped together in a single large prophylactic room. The latter arrangement has certain advantages as to supervision and instruction. In all events it is considered desirable that the prophylactic unit be located in the proximity of the conference room and if there be a periodontist attached to the facility it may be advantageous to have him assigned to the operating room adjoining the prophylactic units and in general charge of prophylaxis. The foregoing arrangement is desirable in that a certain amount of training of dental technicians both in the classroom and at the chair takes place at many of the larger dental activities.

The next grouping of functional components is obviously the prosthetic laboratory and the prosthetic operating rooms or "impression rooms." In those facilities which have prosthetic operating rooms it is considered desirable to locate them contiguous with the laboratory.

It has been stated above that at certain stations a large smoothly functioning prosthetic laboratory is the functional unit which is of prime importance. In this connection it is interesting to note the facility with which the standard prosthetic dental unit can be adapted to the installation of extremely large prosthetic dental laboratories.

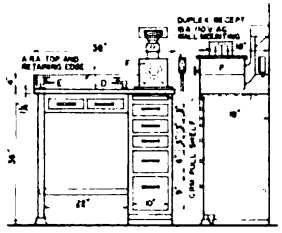
The basic unit has been designed to fit in a space 8 by 10 feet, 1 inch, which is considered the minimum optimal requirement of a Navy prosthetic dental laboratory. This basic unit is the setup that is used aboard ship without any change in dimensions; however a change in arrangement of sections may be necessary due to the shape of the compartment. Shore activities usually have greater requirements and more space available for the prosthetic dental laboratory; therefore the basic unit was designed for assembly in sections so that various sections may be combined to fit existing spaces as depicted in figures 5 to 9.

A brief description of dental prosthetic basic unit No. 3498, figures 5, 6, 7, 8, and 9, is as follows: The over-all length of the left wing is eight feet and the right wing ten feet, one inch. Table tops are 30 inches wide and 36 inches high of a corrosion-resistant metal or material specified. This unit is furnished complete as per specifications

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SPECIFICATIONS FOR DENTAL UNIT NO 3498 & DENTAL WORK BENCH UNIT NO 3496



DENTAL WORK BENCH
(UNIT NO 3496)

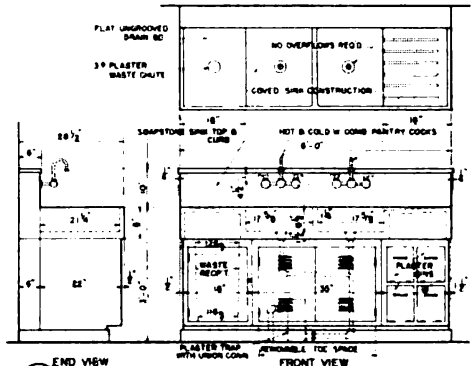
NOTE - SPECIFICATION FOR DENTAL UNIT NO 3498 APPLY ALSO TO DENTAL WORK BENCH
"F" REQUIRED ON ONLY ONE UNIT 3496 PER ROOM

STANDARD MILL THICKNESS TOLERANCES TO APPLY TO SHEET METAL THICKNESS
TOP POLISHED STEEL 0.0747" THICK (ON UNIT 3498, ONLY)
SINK, TANK AND COMPARTMENT I, SAME MATERIAL AS TOP, MADE INTEGRAL WITH TOP
CABINETS TERNE PLATE, TYPE I, CLASS A, FEDERAL SPECIFICATIONS 0.0478 IN THICK
DRAWERS 0.0359 IN THICK, DOUBLE HEAD, GUIDES ON DRAWERS AND CABINETS 0.0598 IN THICK
DOORS SINGLE PLATE, 0.1046 IN THICK
PULLS AND KNOBS BLACK PLASTIC, 3-WAY BOLTS ON DOORS
HINGES METAL, BLACK FINISH, 0.062" THICK, HOSPITAL TYPE, 5 KNUCKLE
CABINET FINISH ACID, ALKALI AND SOLVENT RESISTING BAKED ENAMEL, SELECTED COLOR
A - DUPLEX RECEPTACLE, 110 VOLT, AC
B - COMBINATION SWITCH AND RECEPTACLE 110 VOLTS AC
C - SWITCH FOR IMMERSION HEATER, 110 VOLT AC
D - GAS HOSE COCK "B G
E - AIR HOSE COCK "B A
F - MUFFLE FURNACE.
G - AIR COMPRESSOR } REQUIRED ONLY IF BUILDING IS NOT PIPED FOR GAS AND AIR.
H - GAS TANK }
I - CASTING MACHINE IN COVERED COMPARTMENT.
K - INLAY FURNACE.
L - VULCANIZER
M - VIBRATOR
N - FLASK PRESS
N1 - NO 6 FLASK PRESS WITH EJECTOR AND 4 (FLOOR) "30 EJECTOR FLASKS STOWED IN DRAWER
N 2 - MODEL TRIMMER NO 30
O - WASTE CHUTE
THE CASTING MACHINE "I" CAN BE INSTALLED AS INDICATED OR LOCATED IN SECTION "C C" IF SO, INSTALL DOOR WITH LOUVERS, AND MAKE C C 24" WIDE
UNIT F-F CAN BE RELOCATED IF DESIRED

P-P PROCESSOR TANKS WITH 115 VOLT, 1000 WATT IMMERSION HEATORS AND CAST IRON INTERCEPTOR, TYPE C 2, TRAP, P&P TANKS WITH REMOVABLE COVERS 0.097 IN THICK.
Q - SINK WITH COMBINATION H&C WATER MIXING FAUCET AND WITH LARGE HOSE CONNECTION
R SPLASHERS 0.0359 IN THICK
S - LATHE
T - COLLECTOR
U - WASTE CAN
V - ELECTRIC REFRIGERATOR APPROX 2.7 CU FT CAPACITY
EXTENSIONS TO EITHER WING OF UNIT WHERE SPECIFIED AND SPACE PERMITS SHALL BE MADE BY ADDING CABINET UNITS "A A," "C C," OR "DD" WITH PANEL BACK OF KNEE SPACE; COMBINED AS SPECIFIED
UNIT "BB" SHALL BE PROVIDED WITH LOUVRES
TANK H SHALL BE FULL ENCLOSED.
ALL CABINETS AND EQUIPMENT SHALL BE SECURELY FASTENED IN PLACE
GAS TANK AND COMPRESSOR SHALL BE CONNECTED TO RESPECTIVE COCKS BY 3/8 METAL TUBING
WIRING FOR ELECTRICAL OUTLETS SHALL BE IN STEEL CONDUIT
WATER SHALL BE CONNECTED TO SOURCE WITH 3/8 METAL TUBING
ALL SERVICE LINES SHALL HAVE SHUT OFF VALVES
TRAPS, INTERCEPTOR, DRAIN LINE 1 1/2

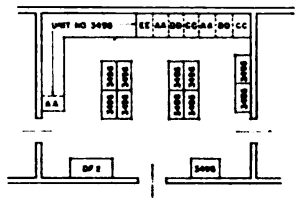
NOTE! WHERE UNIT NO 3498 IS INSTALLED IN SHORE ESTABLISHMENTS HAVING RADIATORS AT WALLS, PROVIDE TOP CURB 10" WIDE WITH GRILLES OVER RADIATORS AND BASE GRILLES IN TOE SPACE IN FRONT OF RADIATORS ACCESS BE PROVIDED TO RADIATORS.
WHEN SECTION "D D" IS ADDED TO THE BASIC UNIT PROVIDE "A" RECEPTACLE "D" GAS AND "E" AIR ASSEMBLY OVER THE "D-D" AREA
WHEN SECTION "E-E" IS ADDED TO THE BASIC UNIT, ADD "D" GAS AND "E" AIR ASSEMBLY OVER "E-E" AREA
CANOPY HOOD AND BLOWER OPTIONAL

DENTAL PROSTHETIC LABORATORY UNITS NUMBERS 3498 & 3496



(DF2) DETAIL OF SINK UNIT IN PROSTHETIC LAB.

NOTE
THIS SINK TO BE USED IN LARGE PROSTHETIC LABORATORIES ONLY (SEE PLANS)



TYPICAL PLAN OF PROSTHETIC LABORATORY
NOT DRAWN TO SCALE
SHOWING APPLICATION OF EXTENSIONS TO UNIT NO 3498

FIGURE 6.

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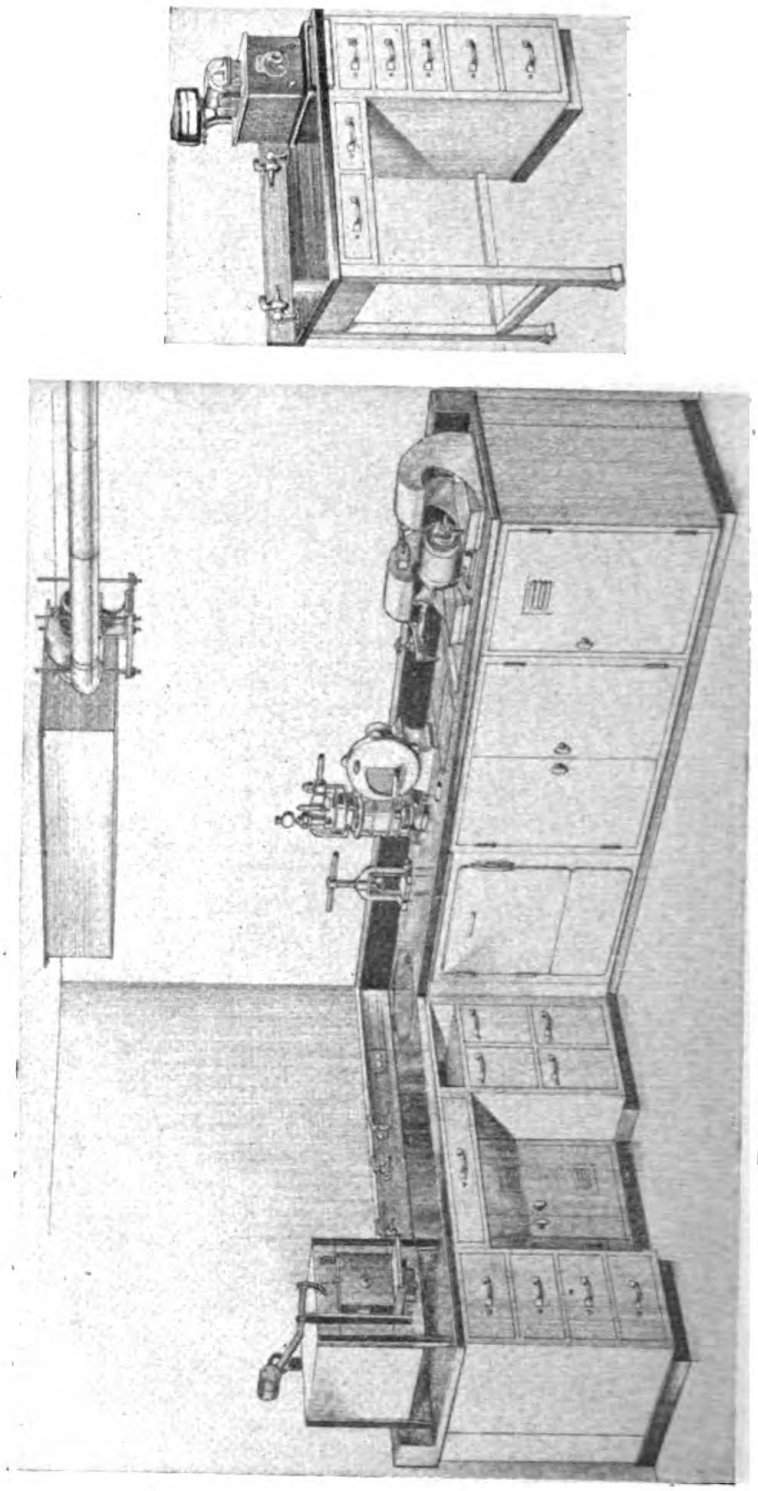


FIGURE 7.—Dental Prosthetic Laboratory Units Nos. 3493 and 3496.

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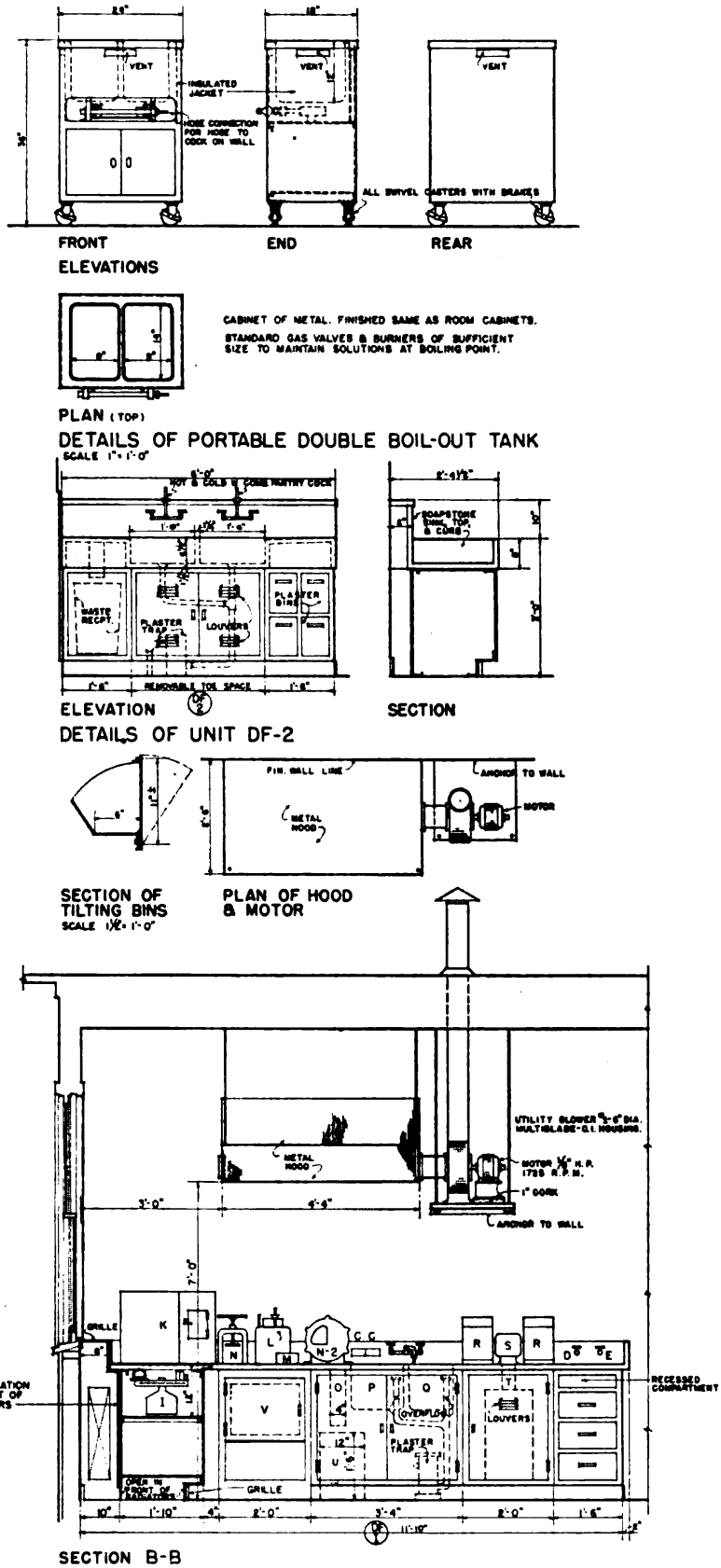
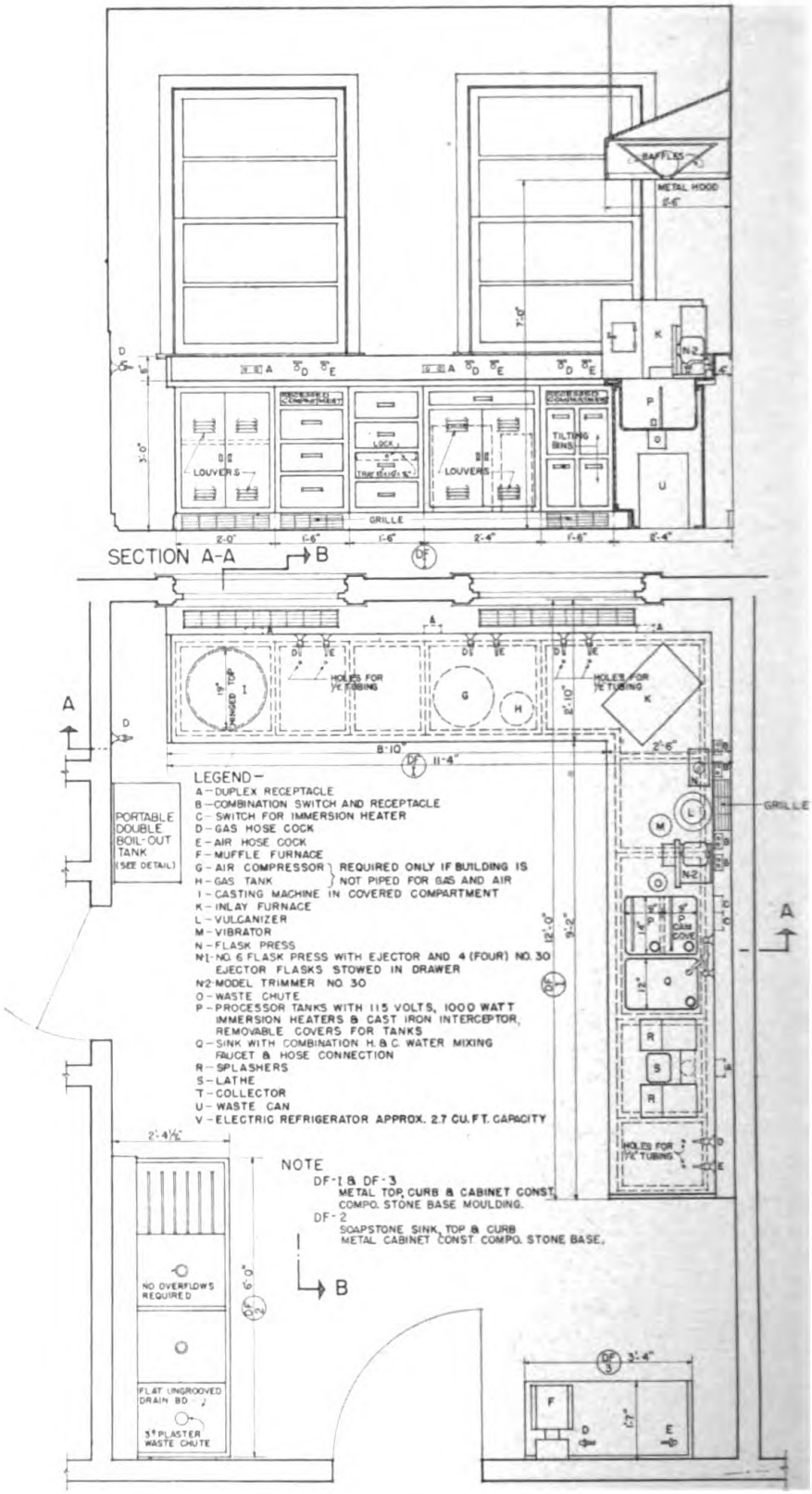


FIGURE 8.

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DENTAL PROSTHETIC UNITS DF-1, DF-2 & DF-3

FIGURE 9.

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as enumerated in legends for figures 5, 6, 8, and 9 with air compressor, gas tank, centrifugal casting machine, inlay furnace, vulcanizer, vibrator, flask press with ejector, model trimmer, processing tanks with immersion heaters, dental lathe, dust collector, and electric refrigerator. A canopy hood ventilator with motor-driven exhaust fan connected to a ventilator exhaust duct is provided to carry away the heat and gases from the laboratory. The hood is installed suspended from the deck or ceiling above the unit, or in a location best suited for its installation.

The dental work bench No. 3496, figure 6, part of the basic unit, has an over-all size of 38 inches in length, 18 inches in width, and stands 36 inches in height. The top is covered with corrosion-resisting metal or other material specified. A ceramic furnace is an integral part of the unit.

The basic unit which comprises units Nos. 3498 and 3496 is provided with sufficient gas, air, and water fixtures. Electrical receptacles and switches of 110-volt, 15-amperes capacity are provided. Where DC current is specified or called for, polarized receptacles and plugs are furnished.

Where more space is available and the anticipated load is greater than the basic unit can carry, unit DF–2 and the mobile boil-out tank as shown in figures 8 and 9 may be provided.

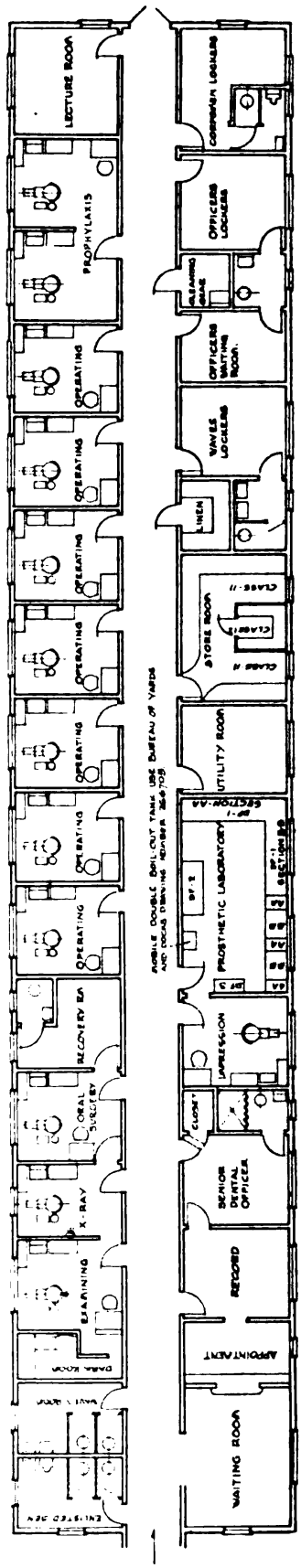
There are numerous other requirements which must be considered in dental planning. They include the provision of toilet facilities and locker rooms for the officers and enlisted personnel attached to the activity; adequate toilet facilities for patients both commissioned and enlisted, male and female; a sufficient number of drinking fountains properly located; the installation of an internal communication system between the appointment desk and operating rooms and a host of other items, some of which may be considered inconsequential within themselves but which in the aggregate are of considerable importance.

If the size of the facility being planned permits, an officers' waiting room should be provided distinct from the general waiting room.

Another feature which it is desirable to include is a utility room. This room may serve for the overhaul, cleaning and minor repair of equipment and has at times been used as an air-compression room in instances where it was not feasible to place compression machinery beneath the building.

The dental department of any hospital or dispensary may be considered an institution within another institution. The modern hospital or dispensary is made up of a collection of agencies and services created for the efficient practice of medicine. The dental clinic is one of major importance. The efficiency of the dental clinic demands the same careful attention on the part of the administrator and archi-

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TYPICAL DENTAL LAY-OUT
FOR
NAVAL SHORE ESTABLISHMENTS

GRAPHIC SCALE

FIGURE 10.

NOTE-
AIR CONDITIONER TO BE PLACED IN EXCAVATION OF THIS BUILDING IF PRACTICABLE - OTHERWISE TO BE PLACED IN UTILITY ROOM

DARK ROOM-ARRANGEMENT
U.S.N. YARD AND DOCKS STANDARD PLAN DRAWING NO 194418 A.

PROSTHETIC DENTAL LABORATORY
ARRANGEMENT OF FURNITURE, BENCHES AND EQUIPMENT,-U.S.N. YARDS AND DOCKS STANDARD PLAN DRWG NO. 194418 AND NO. 246705

DENTAL OPERATING ROOM DESKS
U.S.N. BUREAU OF YARDS AND DOCKS STANDARD PLAN DRAWING NO. 194419A.

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tect in planning the building and arrangement of equipment as is exercised in planning any other unit of the institution. A modern dental clinic of today is an efficient organization, assuring quick and effective attention for the patient. The things most important in dental clinics are not the dental officers and assistants but are the patients and type of services rendered to them.

The four principal divisions in a general dental clinic are the administrative, operative, oral surgery and prosthetic, each of which should have careful study as to its location in the spaces set aside for the clinic.

The following are presented as examples of plans for dental facilities ashore which embody most of the desirable features mentioned in this article.

Figure 10 illustrates a plan for a large dental clinic designed to provide an operative and prosthetic service. The building is a one-story structure, 171 feet long and 32 feet wide. All rooms except the x-ray, appointment room and heads have full length double windows, each 2½ feet wide with a mullion between windows. Small rooms such as x-ray, appointment, and head are provided with different sized windows that meet the architectural requirements of the room and the external esthetics of the building. A corridor 6 feet in width runs the full length of the building and has an entrance at each end. Doors leading from the rooms to the corridor have adjustable transoms for ventilation, except the linen closet and the cleaning-gear locker which are provided with louvered doors and ventilators installed in the walls.

On entering the building, to the right is found the reception room large enough to accommodate both patients awaiting sick call and those who have appointments. Between the appointment room and the reception room is an arched opening with counter shelf for the use of the appointment clerk and patients. The appointment room leads into the record office which in turn opens into the senior dental officer's office. The senior dental officer's office is furnished with a clothes closet and head with shower.

This administrative suite is so arranged that it is easily accessible to all parts of the clinic. Next to the senior dental officer's office is the prosthetic operating room serving the prosthetic laboratory. The prosthetic operating room is provided with a standard setup of dental operating room equipment—chair, unit and cabinet, lavatory bowl, office desk, office desk chair, and lights for dental operations and general room illumination, as shown in the plan of a typical setup for dental operating rooms, figure 1. Next to and communicating with the impression room is the prosthetic dental laboratory which is equipped with a standard setup of cabinets and equipment. Adjacent

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to this room is the utility room used for the repairing of equipment, etc. Storage space for dental material is furnished in the storeroom adjoining the utility room. A linen closet opens into the corridor. Adjoining the linen closet is a locker room for clinic operating personnel (WAVES). The officer-patients' waiting room is located next to the WAVES' locker room. A cleaning-gear room opening by door into the corridor is located between the officer-patients' waiting room and the dental officers' locker room, which is inboard of the head communicating with these rooms. Contiguous with this room is the hospital corpsmen's locker room and head.

On the left side of the entrance are the male enlisted patients' head and the enlisted WAVE patients' dressing room. Adjoining the WAVE patients' dressing room is the darkroom communicating directly with the examination room. Beside the examination room is the x-ray room which is contiguous with the oral surgery. The recovery room is provided with bed and toilet facilities. The x-ray room is located between the examination room and the oral surgery. This permits easy access to the x-ray equipment by both the dental examiner and oral surgeon. The x-ray room is also easily accessible to the operative and prosthetic divisions of the clinic; entrance is by door leading from the corridor. Beyond and adjacent to the recovery room are seven adjoining dental operating rooms and two oral prophylaxis rooms, planned and equipped as shown in figure 10, and a lecture room to be used as a classroom for the instruction of dental officers and hospital corpsmen.

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SULFONAMIDES IN ABDOMINAL SURGERY

There is no indication for the use of sulfonamides in "clean" surgical cases. In infected wounds, however, sulfonamides are not of much value unless a debridement of the grossly infected tissue is carried out first.

Sulfonamides, if dusted lightly into the wound, apparently do not interfere with the normal physiology of wound healing, but they may interfere with wound healing by causing oozing or mechanical separation of tissue edges if too large amounts of the drug are used.

Sulfonamides are most effective in the preperitonitis stage. When gross infection is present, their efficacy is much reduced.—REA, C. E.: Use of sulfonamides in abdominal surgery. Minnesota Med. 27: 99–102, February 1944.

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FUNCTION OF THE MEDICAL OFFICER IN BATTLE ZONES

L. KRAEER FERGUSON
Captain (MC) U. S. N. R.

The current surgical literature on war casualties, wounds, compound fractures, burns, and anesthesia is frequently misleading and harmful because conditions in battle zones differ from those found in civil life. Methods of treatment which are applicable in civil practice cannot be used absolutely in military practice. This is especially true in amphibious warfare and in the jungle battles of the Southwest Pacific action.

The majority of casualties occur during and immediately following the landings on tropical islands, before anything more than emergency medical facilities can be set up. The transportation of the injured to shore or ship medical facilities is often difficult, dangerous, and usually delayed. The number of patients to be treated is usually greatest when the medical facilities are least able to handle them, and when the field hospitals, aid stations and transports themselves are in danger of aerial bombing and shell fire.

The only possible course of action is to give emergency treatment as rapidly and as well as possible and then move the patients by ship or plane to areas of safety. This evacuation of patients must be done early and continuously in order to make room for further incoming casualties. It frequently means that definitive treatment cannot be given for 24 to 48 hours.

Front-line surgery should be primarily lifesaving surgery. This includes the treatment of shock, control of hemorrhage, exploration of abdominal wounds, treatment of surgical emergencies associated with chest wounds, prevention of respiratory obstruction in neck wounds, relief of urinary obstructions, immobilization of fractures, care of soft part wounds, and the relief of pain.

The availability of plasma in convenient packages for early administration is probably the most practical advance in the treatment of shock in this war. To this should be added the relief of pain by morphine and immobilization of the injured part by splints, casts, pressure bandages or recumbency.

It is fairly well established in the literature and demonstrated by experience that the application of external heat is not only unnecessary

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and a waste of time, but may actually be injurious to the patient in shock. Surgical procedures, with the exception of emergency measures to control hemorrhage and immobilize fractures, are best delayed until the patient has recovered from primary shock.

Control of hemorrhage can be accomplished in most instances by local pressure. Tourniquets are necessary only in the control of hemorrhage from large arteries. There is always the danger of their application being insufficiently tight, thereby increasing the venous bleeding. There have been instances of tourniquets being left on for hours with resulting pressure paralysis, where a pressure dressing would have sufficed. Actual clamping or ligation of bleeders is the most satisfactory and only safe way of arresting hemorrhage from large vessels. This necessitates the light, equipment, exposure, assistance and anesthesia of an operating room and cannot be done in the field or in an improvised setup. Until these can be obtained a tourniquet must be used and kept in place to make a bloodless field until the vessels are clamped.

Exploration is demanded in practically all wounds of the abdomen as soon as the patient is out of shock. Spinal anesthesia is the simplest form of adequate anesthesia. Ether anesthesia is influenced by temperature conditions and gas is impracticable because of the cumbersome apparatus. Local anesthesia is too time-consuming and does not give satisfactory anesthesia without splanchnic block. Patients who have recovered from shock tolerate spinal anesthesia very well, especially if intravenous fluids or plasma are given during the operation.

The incision depends upon the site of the wound and the direction taken by the bullet or shell fragment. A midline or rectus incision probably affords the best exposure. The object of the operation is to close gastric and intestinal perforations and to control hemorrhage. No more surgery than necessary should be attempted. Resections should be avoided if possible. Small perforations may be closed by purse-string or over-and-over sutures. Wounds of small gut and stomach do well with simple closure. Wounds of the large gut have a poorer prognosis. Procedures to be considered are delivery of the perforated intestine as a colostomy, suture and delivery of sutured portion of the gut into the wound, and suture and reinforcement of the suture line with the omentum.

Removal of spillage from the stomach or intestines should be as complete as possible. The question of drainage is one that cannot be arbitrarily decided, and depends on the length of time between injury and operation, the amount and kind of spillage, the adequacy of the closure of perforations, etc. As a rule the tendency to drain has been less in wounds of the stomach and small intestine and more in those of the colon.

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When hemorrhage is encountered from wounds of the liver, packing or mattress sutures should be considered as should splenectomy for wounds of the spleen. In retroperitoneal hemorrhage from injuries of mesenteric vessels, the bleeding point is often difficult or impossible to find. The danger of continued hemorrhage with the possibility of spontaneous stopping of the bleeding must be weighed against the danger of a traumatizing and often unsuccessful search for the bleeding point. The location of the point of entrance of the injuring object into the mesentery is often an aid in making the decision as to further exploration or leaving things alone.

Before closure one of the sulfonamides should be introduced into the abdomen. Five gm. (25 cc.) of the 20-percent suspension of microcrystalline sulfathiazole has proved most effective. It can be uniformly distributed in the abdomen with a urethral syringe and does not cake or clump. Next best is 5 to 8 gm. of sulfanilamide crystals.

The abdominal wound may be closed in the usual manner when wounds of the small intestine or stomach are found, but because of the almost invariable infection of the wound when large gut injuries are encountered, it is better not to suture the skin or fat layers. All the wound layers should be sprayed with sulfonamide powder before suturing.

The wounds of entrance or exit may be handled as time and conditions permit. Usually the least done the better.

Three surgical emergencies for battle wounds of the chest which are amenable to treatment are hemothorax, open pneumothorax and tension pneumothorax.

Hemothorax may become so massive as to cause marked dyspnea. In such a case and usually only under such circumstances is chest aspiration warranted. In open pneumothorax or sucking wounds of the chest, air rushes in and out of an open wound of the chest with each respiration. The flapping back and forth of the lung and mediastinal structures with each breath causes rapid exhaustion and early death unless the wound can be closed by suture or tight dressing. In emergency treatment only one or two sutures are necessary. In small wounds vaseline gauze packing does very well. The patient experiences almost immediate relief when the open pneumothorax is converted into a closed one.

Tension or pressure pneumothorax occurs when the air can enter the pleural cavity through a bronchial injury but cannot escape. Increasing dyspnea made worse by coughing or straining, absence of breath sounds and displacement of the cardiac dullness to the side opposite the injury are characteristic signs. Widespread subcutaneous emphysema is often present. The introduction of a large caliber

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needle will permit the pressure in the pleural cavity to become that of the atmosphere, and a tube, from the needle, leading under water in a bottle will keep it so. A condom, slit at the end, makes an excellent valve and can be tied over a tube and used in place of the bottle.

Wounds of the mouth and neck are often associated with sufficient swelling to block the respiratory passages, and the tracheotomy must be performed as an emergency measure. The presence of bleeding in the pharynx and mouth from upper facial wounds is often disturbing to the patient and doctor and tracheotomies have been performed in such cases. Usually such bleeding can be controlled by packing and a tracheotomy is not necessary.

Wounds of the perineum and genitalia are often associated with marked swelling and even urinary extravasation. Usually a catheter cannot be inserted and a cystostomy must be performed to prevent extravasation and urinary retention. Bladder wounds can usually be taken care of by an abdominal exploration. An indwelling catheter is often necesssary to relieve the retention associated with the paralysis of spinal injuries.

The immobilization of fractures is of importance not only for the treatment of the fracture itself, but also for the treatment and prophylaxis of shock. Since about one in every three patients has a fracture and about 80 percent of the fractures are compound, this presents a large problem. The aim should not be to make an extensive attempt at reduction but simply to immobilize, in the lower extremity by traction in a Thomas splint and in the upper extremity by traction or splints. Plaster may be used if adequate facilities are available. Reduction and definitive treatment can best wait until adequate facilities are available.

Care of soft part wounds occupies a large part of the thought of writers on war surgery. There is much talk about debridement and the possibility of primary suture. When handling a large number of casualties there is not time or place to do debridement. Furthermore many of the wounded reach the operating room long after the period of contamination is past. Finally, since the local use of the sulfonamides, the necessity or even the advisability of debridement is questionable.

The best method of treatment is a thorough irrigation of the wound with saline, removal of foreign bodies such as clothing, shell fragments and cocoanut hull when present in the wound, the introduction of sulfathiazole or sulfanilamide into all parts of the wound, and the application of a pressure dressing. If facilities are not available for proper cleansing of the wound, the introduction of the sulfonamide locally and application of a dressing will prolong the period of contamination enough to permit the transportation of the patient to a place where proper facilities for adequate wound care are at hand.

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Attempts at debridement in front-line hospitals are unnecessary and usually inadequate; any suturing of wounds is not only harmful but dangerous. Even if all the facilities and time were available, it is believed the interests of the patient are best served by a simple regimen of wound lavage, removal of accessible foreign bodies, local introduction of sulfathiazole or sulfanilamide and application of a pressure dressing. In large wounds immobilization of the part should be added.

Craniocerebral injuries were not listed as requiring emergency surgery other than the treatment of the wound. In gunshot wounds of the head, cerebral compression due to edema or hemorrhage is not usually the problem met in civil life. The type of injury produced by shell fragments and bullets usually acts as a decompression of itself. If symptoms of compression appear, then of course relief of pressure by repeated spinal punctures or decompression is necessary as a life-saving measure. Exploration with removal of bone fragments or foreign bodies of other types is best delayed until adequate facilities and time are available.

The problem of prime importance in these cases is the prevention or minimizing of infection. This is best accomplished by adequate care of the wound as described above, with the important proviso that sulfanilamide or sulfadiazine powder should be used locally. Sulfathiazole powder should never be used because it has been shown to produce convulsions when in contact with brain tissue.

Although the local application of the sulfonamides after thorough wound lavage is probably the most important measure in the prevention of spreading infection in traumatic wounds, it must not be forgotten that these drugs by mouth are also helpful in this regard. Sulfathiazole or sulfadiazine given in an initial dose of 2 to 4 gm. and continued in 1-gm. does every 4 hours produces an early and adequate blood level. The drug by mouth should be continued for 3 or 4 days in this dosage and gradually reduced thereafter. It is important that the fluid intake be maintained during the administration of the sulfonamides.

The relief of pain is understood as a prime function of front-line care. This is best done by adequate morphine administration, but the value of immobilization of the injured part and systemic rest must also be remembered. All of these measures are accessory methods in the prophylaxis and treatment of shock.

Aboard a hospital ship, patients were received from ships and shore stations at all stages from hours to weeks after their injury. The transition from emergency field hospitals to well-developed medical facilities has been noted and with this transition the tendency to do more radical and extensive surgery as the primary treatment, such as debridement and suture of wounds, search for foreign bodies, amputations, and the like.

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The definite impression was obtained that the patient did better when only conservative emergency treatment could be given. There is a tendency to do too much rather than too little, as more hands and facilities become available. If medical officers in battle areas would look upon their function as lifesaving by giving emergency treatment and do nothing more than will accomplish this mission, more lives will be saved and morbidity will be decreased in battle casualties.

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SULFADIAZINE PROPHYLAXIS AGAINST SCARLET FEVER

At this Naval training school an outbreak of scarlet fever began late in November 1943. By 8 December 1943 there had been a total of 7 cases.

On 9 December 1943, the entire student personnel was Dick tested. A commercial toxin (Lederle) was used. Of 296 men tested, exactly 100 were Dick-positive, the average age of the men being between 18 and 21 years.

On 10 December 1943, prophylactic sulfadiazine, 1 gm. daily for 12 days, was instituted, being given to approximately half the personnel (149) regardless of the results of the Dick test. During the 12-day period 7 more cases appeared, 1 of which had been Dick-negative.

Case	Date illness began	Dick reaction	Received sulfadiazine
1	12-12-43	Positive	No.
2	12-12-43	do	Yes.
3	12-14-43	Negative	Yes.
4	12-15-43	Positive	No.
5	12-18-43	do	Yes.
6	12-20-43	do	No.
7	12-20-43	do	No.

Thus, we may see that 3 of the cases (almost half) had received sulfadiazine when illness began, 1 for 3 days, 1 for 5 days, and 1 for 9 days.

There were 3 drug eruptions, none of them serious.

Although this is a small series, the results do not appear to favor the use of sulfadiazine as a prophylactic against scarlet fever. We agree, however, with Watson that the number of daily sick calls due to respiratory infection were definitely decreased.—CARMEL, P. D., Lieutenant (MC) U. S. N. R.

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ONCENTRATIONS OF SULFONAMIDES IN WOUND EXUDATES FOLLOWING ORAL ADMINISTRATION

AN EXPERIMENTAL STUDY

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and
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the various sulfonamides for local and systemic use in the pro-xis and treatment of wound infections, investigators have rec-ended sulfanilamide, or a combination of sulfanilamide and an- sulfonamide in equal parts for topical application, whereas diazine has been suggested for systemic administration (*1*) (*2*) There is considerable information regarding local concentra- and blood levels attained when the sulfonamides are implanted unds. On the other hand, data concerning concentrations of the namides in wounds following their administration by a systemic are surprisingly meager. It is this problem which has been of ipal interest in this investigation.

lfanilamide, sulfathiazole and sulfadiazine are readily absorbed the gastro-intestinal tract and reach peak levels in the blood in hours. Following absorption the sulfonamides are distributed ghout the body fluids where the concentrations reached are equiv- to those in the blood. Since the distribution in the tissues is ortional, in part, to their water content the levels are lower in and fat. Concentrations in excess of the blood levels have been in bile (*4*) and milk from the lactating breast (*5*). Meleney Lockwood (*6*) state that the sulfonamides may be two or three more concentrated in inflammatory exudates. Passage of these through the normal choroid plexus is variable. Sulfanila- and sulfadiazine penetrate readily, while with sulfathiazole a ntration exceeding 25 percent of the blood level is seldom ob-d. To our knowledge there are no data relative to the question lfonamide concentrations in wound fluids following systemic nistration.

pe (*7*) has compared sulfadiazine levels in the blood and vesicle of patients with burns. In one patient the bleb and blood con-ations were comparable (4.3 mg. percent) 14 hours after the

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burn and 12 hours after sulfonamide therapy was begun. However in another instance where sulfadiazine was withheld for 60 hours following the burn, the concentration was lower in the vesicle fluid (3.3 mg. percent) than in the blood (8 mg. percent) 12 hours later. Cope notes that the unruptured blebs of these patients receiving sulfadiazine rarely contained pathogenic bacteria even though the burned areas were unprotected. In several of our clinical cases we found that the sulfadiazine levels of serosanguineous wound exudates exceeded the concentrations of this drug in simultaneously obtained blood samples. This discrepancy did not occur when the material from the wound was obviously a liquefying hematoma. Under these circumstances the blood and wound levels were similar.

Efforts to pursue this investigation clinically were impeded by the infrequency of serous wound collections among the surgical cases. Because of this the study was transferred to the laboratory where exudative wounds have been produced in guinea pigs. To promote the outpouring of tissue fluids into the wound, oxidized cellulose materials were implanted. The oxidation of cellulose by nitrogen dioxide has been reported by Kenyon and his collaborators (*8*) (*9*). Studies of tissue reaction to oxidized papers, gauze and cotton prepared by these workers have been reported by Frantz (*10*) and Putnam (*11*). Use of these materials in this investigation came as a result of finding serosanguineous collections in wounds in which they had been implanted. When in contact with the alkaline tissue fluid the cellulose goes into solution and is subsequently absorbed.

METHODS AND MATERIALS

Operative technic.—Guinea pigs averaging 500 gm. in weight were used. Anesthesia was obtained with intraperitoneal nembutal supplemented with ether by inhalation. After closely clipping the hair on the back, the skin was prepared with 95-percent alcohol and 2½-percent tincture of iodine. The field of operation was draped with sterile towels. A midline incision, 6 to 8 cm. in length, was used routinely. After undercutting the skin on both sides to form a pouch for the implantation of the oxidized cellulose, the exposed fascia and musculature were superficially lacerated with the scalpel. Four or five strips of oxidized onionskin paper, averaging 1 by 4 cm. were twisted into a single roll and placed in the subcutaneous pouch on one side. These paper strips had been immersed in 95-percent alcohol in a sterile test tube for at least 24 hours prior to use. The papers used were labeled G, H, and I, and had been oxidized for 3 hours, 5½ hours, and 8 hours respectively. In three of the control animals, strips of sterile, nonoxidized absorbent cotton of similar

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dimensions were used. The wounds were closed with cotton sutures. No dressings were applied.

Administration of the sulfonamides.—On either the 2d or 3d postoperative day the animals were started on sulfanilamide, sulfathiazole, or sulfadiazine by mouth. These sulfonamides were prepared as a 10-percent suspension in a 5-percent aqueous solution of gum acacia. The suspension was administered slowly through a malleable silver needle extending into the pharynx. An initial dose of 2 cc. (200 mg.) was given at 0800 followed by 1 cc. (100 mg.) every 4 hours, omitting the dose at 0400. Administration of the sulfonamide was continued for a period of 48 hours. In each series of 6 animals 1 was used as a control and did not receive the sulfonamide.

Blood and wound samples.—Samples of wound fluid were obtained at 1, 3, 6, and 12 hours in a small number of the animals and in all at 24, 48, and 96 hours following the first dose of the drug. The 96-hour sample, therefore, represents the concentration of the drug in the wound 48 hours after medication was discontinued. These wound fluids were serosanguineous in character. With the passage of time there was a progressive decrease in the number of red blood cells.

Each time the wound collections were aspirated, 1.5 cc. of blood were removed by cardiac puncture. Both the wound and blood samples were placed in test tubes containing potassium oxalate.

Bratton and Marshall's (*12*) method was used to determine the concentration of the free sulfonamide in the whole blood and in the wound fluid. Conjugated sulfonamides were not determined because the small volume of the wound samples did not permit an accurate determination of both the free and acetylated forms.

Autopsy.—At the termination of the experiment on the 7th or 8th postoperative day the animals were killed by injection of air intracardially. The wounds were opened and particular care was taken to note the character and the amount of the exudate and, in addition, the degree of absorption of the oxidized paper.

RESULTS

The results of this study are presented in tables 1, 2, and 3. In the compilation of the data we have eliminated sulfonamide determinations made on animals who were obviously dehydrated or in poor condition. Furthermore, wound samples less than 0.5 cc. in amount are not included.

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TABLE 1.—*Concentrations of free sulfanilamide in concurrent wound and blood samples at periodic intervals of time following the initial oral dose*

Animal number	Material implanted in wound	1 hour		24 hours		48 hours		96 hours	
		Blood level	Wound level	Blood level	Wound level	Blood level	Wound level	Blood level	Wound level
		Mg. percent	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*
S-37	Paper G	11.3	10.0	6.2	4.3	5.4	4.1	0	v. ft. tr.
S-39	do			2.7	tr.			0	v. ft. tr.
S-40	do			4.1	3.1	3.7	5.8	ft. tr.	tr.
S-41	do			tr.	1.6	1.3	5.0	0	tr.
S-61	Paper H	5.5	4.3	.5	1.5	1.8	2.1	0	0
S-62	do							0	0
S-65	do			1.5	4.6			tr.	tr.
S-79	Paper I	6.5	10.1	3.1	6.2	6.0	10.7	0	tr.
S-80	do	1.8	8.6	3.7	6.2	6.0	9.7	0	0
S-81	do			.5	2.8	3.0	5.6	0	0
S-82	do					7.2	14.4		
S-84	Abs. cot	2.5	10.4	1.4	11.3	4.2	8.4	0	0
S-85	do			1.6	6.5	2.5	9.3	0	0
S-86	do			5.0	11.8			0	0
Total number animals		5	5	12	12	10	10	13	13
Average levels		5.5	8.7	2.6	5.0	4.1	7.5		
Wound blood ratios		1.58		1.92		1.83			

TABLE 2.—*Concentrations of free sulfadiazine in concurrent wound and blood samples at periodic intervals of time following the initial oral dose*

Animal number	Material implanted in wound	1 hour		24 hours		48 hours		96 hours	
		Blood level	Wound level	Blood level	Wound level	Blood level	Wound level	Blood level	Wound level
		Mg. percent	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*
S-65	Paper G	4.6	5.2	2.8	7.0	3.1	8.3	1.5	1.5
S-44	do	4.9	6.1	4.2	7.5	4.6	11.0	tr.	1.4
S-45	do			3.3	5.7	2.6	6.5	ft. tr.	tr.
S-47	do			3.2	8.0	3.4	9.2	tr.	1.5
S-55	Papers G and H			8.2	9.0				
S-56	do	3.8	5.2	6.0	8.3	4.9	7.1	v. ft. tr.	v. ft. tr.
S-57	do			6.3	8.9	5.9	7.5	v. ft. tr.	ft.tr.
S-58	do			8.6	12.2	8.6	11.8	1–1.5	1–1.5
S-59	do			8.3	11.8	4.3	6.0	v. ft. tr.	v. ft. tr.
Total number animals		3	3	9	9	8	8	8	8
Average levels		4.4	5.5	5.7	8.7	4.7	8.4		
Wound blood ratios		1.25		1.53		1.78			

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TABLE 3.—*Concentrations of free sulfathiazole in concurrent wound and blood samples at periodic intervals of time following the initial oral dose*

Animal number	Material implanted in wound	1 hour		24 hours		48 hours		96 hours	
		Blood level	Wound level	Blood level	Wound level	Blood level	Wound level	Blood level	Wound level
		Mg. percent	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*	*Mg. percent*
S–49	Paper G	6.2	3.2	7.1	6.8				
S–50	do	tr.	ft. tr.	2.6	2.1				
S–51	do			2.2	1.9			0	0
S–52	do			1.1	1.6	1.5	1.4		
S–53	do			3.0	3.2			tr.	tr.
S–67	Paper H	6.4	7.2						
S–73	do	9.4	3.1	4.9	5.5	9.9	5.0	ft. tr.	1.7
S–74	do	2.2	2.2	3.9	3.0	3.0	3.0	0	0
S–75	do			14.2	3.9			0	tr.
S–76	do			6.9	5.5	10.0	7.3	0	tr.
S–77	do			3.9	4.5			0	0
Total number animals		5	5	10	10	4	4	7	7
Average levels		4.9	3.2	5.0	3.8	6.1	4.2		
Wound blood ratios		0.65		0.76		0.69			

The data indicate that sulfanilamide, sulfathiazole, and sulfadiazine penetrate at chemotherapeutic levels into the wounds produced in these animals. With few exceptions, the concentrations of free sulfanilamide and free sulfadiazine in the wound fluids were higher than the levels in the corresponding blood samples (tables 1 and 2). In contrast, the sulfathiazole level in the wound fluid has generally been below the blood level (table 3). Analysis of the 96-hour samples indicates that sulfathiazole and sulfadiazine, particularly the latter, have a tendency to remain in the wound for a longer period of time than sulfanilamide. In the majority of animals sulfanilamide had disappeared from the wound and the blood 48 hours after the last dose.

In the three animals in which nonoxidized absorbent cotton was implanted, the sulfanilamide levels in the wound and blood samples were comparable to the values obtained with the oxidized paper. This suggested that the oxidized cellulose technic has not affected the end-results.

At autopsy the wounds were found carpeted with moist granulation tissue in which loculated collections of serosanguineous fluids were frequently found. To gross observation all three types of oxidized paper were invariably absorbed after 7 to 8 days. However, microscopic sections were not made. In view of this rapid absorption, it is interesting that the wound collections increased progressively in amount and the largest samples were aspirated on the last day. These samples averaged 1.5 to 2 cc. in amount with an occasional aspiration as large as 5 to 6 cc., a large collection when the size of the animal is considered.

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COMMENT

Interpretation of these findings lies, to a considerable extent, in the realm of wound chemistry. Such factors as the extent of acetylation of the sulfonamides in the blood and the wound, their binding to protein molecules, their distribution between red blood cells and plasma, the hypertonicity of the wound exudate, and the influence of pH are among the problems to be considered.

Explanation of the low wound levels of sulfathiazole, in contrast to sulfadiazine and sulfanilamide, on the basis of increased acetylation in the wound is untenable since acetylation is carried out by the liver. Furthermore, under normal conditions, sulfanilamide undergoes a greater acetylation in the body than does sulfathiazole.

Davis (*13*) has shown that there is a considerable binding of the sulfonamides to albumin. This binding is greatest for sulfathiazole, less with sulfadiazine and least with sulfanilamide. He points out that this phenomenon accounts for the distribution of sulfonamide drugs in body fluids, for example, spinal fluid. Davis' explanation is of considerable interest in the interpretation of our findings. Since sulfathiazole in the plasma has a ratio of bound to free drug per gram of protein of 55 percent, it would be expected to penetrate into the wound fluid in low concentrations, since only the unbound molecules are diffusible. On the other hand, sulfanilamide and sulfadiazine with binding values of 4.6 percent and 21 percent, respectively, would diffuse in higher concentrations. Davis' explanation would satisfactorily account for the findings in this study.

No measurements of the osmotic pressure of the wound exudates were made. However, since glucose is theoretically a break-down product of absorbable cellulose, reducing substances in the wound samples were determined by Folin and Malmros' method. These analyses were made on a series of wound fluids obtained from the 3d to the 7th postoperative days. Without exception the reducing substances have been considerably lower in the wound fluid than in the blood. In contrast, when oxidized cellulose was dissolved in pooled human plasma the reverse was true.

Variations in the normal distribution of the drugs between red blood cells and plasma would not account for the differences in distribution between the blood and wound exudates. Investigators have demonstrated that sulfanilamide is found in greater concentrations in whole blood than in plasma, whereas sulfadiazine and sulfathiazole are distributed in greater concentrations in plasma. If this were the explanation one would expect sulfathiazole and sulfadiazine to have given parallel results in this investigation.

In a few instances the pH of corresponding blood and wound samples was measured. Invariably, the pH of the exudates of wounds con-

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taining oxidized cellulose has been lower than the pH of the blood. In contrast, exudates of wounds containing plain catgut have been more alkaline. Thus the high wound concentrations of all three sulfonamides are not explainable on the basis of increased solubility of the sulfonamides in the wound exudate, since these drugs are known to be more soluble in an alkaline medium.

In conclusion, we wish to point out that our chief interest in this investigation has been to determine the concentrations of free sulfanilamide, sulfathiazole and sulfadiazine which can be obtained in wound exudates when these drugs are administered systemically. The method of production of the wound exudate with oxidized cellulose is open to criticism since it does not simulate the conditions which are obtained in the usual traumatic or surgical wounds. However, our control wounds containing comparatively inert, nonoxidized absorbent cotton, a foreign body, have given equivalent results. These findings require further confirmation by determination of the wound and blood sulfonamide concentrations of clinical cases.

SUMMARY

1. A method for producing exudative wounds in guinea pigs by implanting oxidized cellulose subcutaneously is described.

2. The animals were given sulfanilamide, sulfathiazole or sulfadiazine by mouth and determinations were made of the level of the free sulfonamide in concurrent blood and wound samples.

3. Satisfactory levels of all three sulfonamides were obtained in the wounds 1 hour following the first oral dose.

4. Sulfanilamide and sulfadiazine concentrations in the wound exudates have generally exceeded the blood level, whereas the sulfathiazole content of the wound was equivalent to or below the blood level.

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APOMORPHINE IN PAROXYSMAL TACHYCARDIA

Paroxysmal tachycardia is a fairly common functional disturbance of the heart, usually of little significance, but occasionally requiring medical treatment because of its persistence. Vagus stimulation, by mechanical or chemical means, produces the best results. Digitalis is rarely indicated. An attack should be stopped before signs of cardiac insufficiency develop. One of the most effective drugs is mecholyl. A somewhat similarly acting and equally effective drug is apomorphine, and may be available when mecholyl is not. In the author's experience over several years, apomorphine has been preferred to mecholyl by patients who have at different times received both drugs. To date, it has never failed to stop an attack. Since the treatment has not found wide use in this country, judging by the lack of mention in the literature, a brief discussion may be of value.

Schöne attributes the effectiveness to both a vagus action and a direct action on the cardiac muscle, basing his opinion on electrocardiographic tracings of human and experimental animal hearts. In the perfused cat heart, there was indication that the coronary circulation was reduced during the administration of the drug, which led Schöne to the conclusion that coronary sclerosis would be a contraindication to its use.

The treatment is simple. Apomorphine is given subcutaneously in a dose of $\frac{1}{20}$ to $\frac{1}{10}$ grain (3 to 6 mg.). Within 5 minutes, when nausea begins, a finger on the pulse will detect a slight irregularity, which changes quickly to regular rhythm with markedly reduced rate. Following vomiting, the patient relaxes and within a few hours feels well. No harmful after effects have been noted in any of the author's cases.—NEEDELS, L. J., Lieutenant Commander (MC) U. S. N. R.

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ADVANTAGES AND LIMITATIONS OF INTRAVENOUS SODIUM SULFATHIAZOLE

GEORGE MILLES
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The spread of an infection is controlled by the rise of resistance in the tissues and fluids immediately ahead of the proliferating and therefore advancing bacteria and their toxins. If this is true, then inhibition of the reproduction of an invading organism slows the rate of spread into the tissues and permits the tissues to develop resistance before they are overwhelmed. It would follow that the inhibiting property of sulfathiazole is most effective when the drug reaches the viable tissues about the infected area at the earliest moment in the highest safe concentration.

Conjugation of sulfathiazole to the acetylated form occurs chiefly in the liver. Taken by mouth the drug is absorbed into the portal circulation and passes through the liver in its entirety, exposing it to acetylation before it reaches the general circulation. Administered intravenously, little of the drug reaches the liver until it has traversed the peripheral circuit, thereby exposing the tissues to the peak concentration of the drug in its original form. When the drug is administered intravenously the percentage acetylated should be less than when the drug is administered orally.

It is possible that the ratio of the dose and of the speed of therapeutic success to the toxicity of the drug, might clearly favor one or the other route of administration.

The records of a consecutive series of patients who had been treated with intravenous sodium sulfathiazole were studied to test the validity of these theories. The drug was administered by syringe in from 5- to 20-percent solution; the maximum dose was 3 gm. Local tissue irritation was not noted. The daily urinary output was measured, and in those who were given the drug intravenously only, was examined microscopically for blood and crystals on one or more occasions.

Circumstances precluded more detailed studies, though in previous observations blood levels of approximately 20 mg. per 100 cc. of blood immediately after the intravenous administration of 3 gm. of sodium sulfathiazole and falling to less than 1 mg. at the end of 24 hours were obtained. The cases were grouped according to whether or not sulfonamides were administered orally as well as intravenously and are summarized in tables 1, 2, 3, and 4.

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TABLE 1.—*Single dose of sodium sulfathiazole intravenously*

Case No.	Diagnosis	Admitting temperature	Dosage	Results
		°F.	Gm.	
1	R. L. L. pneumonia	102	3	Findings normal 7th day.
2	do	100.2	3	Do.
3	DU (Acute appendicitis)	100.2	3	Symptom free 3d day.
4	Fever, cause unknown	103	3[1]	Temperature normal 11th day.
5	do	102	3[2]	Temperature normal 6th day.
6	Abscess, left index finger	99.2	2	Temperature normal 2d day.
7	Abscess, right hand	99.2	3	Do.
8	Acute sinusitis	100.8	3[3]	Temperature normal 3d day.
9	Lymphadenitis, left supraclavicular	98.6	3[4]	To duty on 5th day.
10	Measles	102	2	Not influenced by treatment.
11	do	102.6	2	Do.
12	Thrombophlebitis, right iliac vein	102.6	3[2]	Patient died.

[1] Administered on 10th day of illness.
[2] Administered on 5th day of illness.
[3] Administered on 2nd day of illness when T. rose to 103° F.
[4] Administered on 3d day of illness.

TABLE 2.—*Single dose of intravenous sulfathiazole and oral sulfonamide*

Case No.	Diagnosis	Admitting temperature	Dosage		Results
			Intravenous	Oral	
		°F.	Gm.	Gm. every 4 hours	
13	R. L. L. pneumonia	103.4	3	½	Temperature normal 2d day
14	do	101.2	3	[1] 1	Temperature normal 3d day.
15	do	101.4	3[3]	[1] 1	Do.
16	do	103.4	3[3]	1	Do.
17	Carbuncle of neck		2	[2] 1	Healing uneventful.
18	G. S. W., compound fracture left metatarsals.	99	3	1	Temperature normal 2d day.
19	G. S. W., compound fracture scapula.	99	3	½	Temperature normal 3d day. Temperature normal 4th day.
20	G. S. W., face and shoulder	100	3	1	Temperature normal 2d day.
21	H. E. W., lumbar region	101.2	3	1	Temperature normal 2d day.
22	H. E. W., compound fracture scapula.	99	3	1	Temperature normal 2d day.
23	G. S. W., compound fracture right zygoma, maxilla.	99	3	1	Do.
24	G. S. W., compound fracture left humerus.	100.8	3	1	Condition good 6th day.
25	G. S. W., compound fracture skull.	98.6	3	1	Temperature normal 5th day.

[1] Oral sulfathiazole discontinued 2d day.
[2] Oral sulfathiazole discontinued 4th day.
[3] I. V. on 2d day.

TABLE 3.—*Multiple doses of sodium sulfathiazole intravenously*

Case No.	Diagnosis	Admitting temperature	Dosage	Results
		°F.		
26	Fracture nose; septicemia	102	3 gm. stat., 6 gm. in 48 hours.	Temperature normal 9th day.
27	DU (Acute appendicitis)	99	3 gm. stat., 7 gm. in 48 hours.	Symptom free 7th day.
28	do	98.6	3 gm. stat., 5 gm. in 24 hours.	Symptom free 2d day.
29	Pyelitis, acute	99.6	3 gm. stat., 12 gm. in 72 hours.	Symptom free 12th day.
30	Abscess, periapical	100.4	4 gm. in 36 hours	Symptom free 3d day.
31	Otitis interna	98.6	6 gm. in 48 hours	Recovered 5th day.
32	G. S. W., buttock and flank	99.8	3 gm. stat., 11 gm. in 60 hours.	Good condition 4th day.
33	G. S. W., compound fracture mandible.	100.2	10 gm. in 120 hours	Good condition 6th day
34	G. S. W., chest and abdomen; ruptured spleen.	99.8	9 gm. in 72 hours	Do.
35	G. S. W., abdomen; perforation small intestine.		3 gm. every 24 hours	Died. No peritonitis.
36	Urethritis, chronic		9 gm. in 48 hours	Reaction to sulfathiazole
37	Erysipelas, right thigh		3 gm. stat., 5 gm. in 24 hours.	Not influenced.

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TABLE 4.—*Multiple doses of sodium sulfathiazole intravenously and oral sulfonamide*

Case No.	Diagnosis	Admitting temperature	Dosage		Results
			Intravenous	Oral	
		°F.			
38	Meningococcus meningitis.	101.4	3 gm., stat., 7 gm. in 36 hours.	1 gm. every 4 hours.	Symptom free 24 hours.
39	... do	99.8	3 gm. stat	(1)	Temperature normal 2d day.
40	Inguinal adenitis, left	100	1 gm. every 8 gours [2].	1 gm. every 4 hours.	Temperature normal 3d day.
41	Acute appendicitis	100	6 gm	do	Temperature normal 5th day.
42	GC infection, urethra		3 gm. stat., 1 gm. in 24 hours.	do	Smear negative 4th–7th days.
43	Otitis externa	98.6	3 gm. stat., 7 gm. in 48 hours.	do	Symptom free 3d day.
44	G. S. W., soft tissues forearm and back.	99	3 gm [3]	do	Symptom free 5th day.
45	R. L. L. pneumonia	101.8	3 gm. stat	do	Temperature normal 4th day.
46	Abscesses of skin, recurrent.		3 gm. daily for 5 days.		Symptom free 14th day.

[1] Three gm. sodium sulfapyridine also administered intravenously.
[2] Begun 2d day.
[3] Begun 4th day, oral discontinued.

ANALYSIS OF CASES WITH REFERENCE TO INTRAVENOUS ADMINISTRATION

Though the number of cases is small, certain limited conclusions may be drawn.

Toxicity.—Hematuria without crystalluria occurred in one instance, suggesting a direct toxic effect of the drug on the kidneys.

Vomiting occurred during or shortly after the administration of the drug in three instances. Since it was not constant on repeated intravenous administration in the same subject and since it was never delayed, it was very likely due to the speed with which the solution was injected.

Headache, delayed in onset, occurred in one subject who had noted the same symptom when the drug was administered orally.

One patient who displayed a clear-cut intolerance to the drug when administered orally, as indicated by fever and vomiting, tolerated the drug intravenously without the slightest reaction.

Crystalluria was not noted in any instance. This is contrary to the observation of other authors. The apparent contradiction may be explained by the smaller dose used in this series.

Therapeutic effectiveness.—There were 15 in which the drug achieved good clinical results with a total dose smaller than would be expected to be effective orally.

In nine cases the drug achieved good clinical results when administered intravenously after sulfathiazole had apparently failed when given by mouth.

The drug was ineffective in five cases.

There were 16 cases in which the results of therapy with sodium sulfathiazole administered intravenously were equivocal.

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The most apparent objective results were achieved in those patients suffering from superficial abscesses. The zone of redness, tenderness, and swelling was usually markedly reduced within 24 hours even before drainage was established. On the other hand failure to achieve a therapeutic response, such as was noted in measles, was evident within 24 hours.

For the purpose of this report the diagnosis of appendicitis was not considered established in the absence of operative removal of the appendix.

In the treatment of certain casualties in which oral medication is contraindicated, sodium sulfathiazole administered intravenously has much to recommend it.

SUMMARY

1. In one instance sodium sulfathiazole was tolerated when administered intravenously after repeated doses of sulfathiazole orally caused fever and vomiting.

2. The individual dose of sodium sulfathiazole administered intravenously in this series did not exceed 3 gm.

3. This dose of the drug gives rise to little or no crystalluria.

4. The toxic reactions noted were hematuria without crystalluria, one instance, vomiting, three, and headache in one case.

5. The intravenous route of administration of sodium sulfathiazole is preferable to the oral route in those infectious diseases in which the prognosis as to mortality, complications, and sequelae, is at all grave, such as purulent meningitis, pneumonia, peritonitis, and acute osteomyelitis, and in injuries in which the probability of infection is high such as abdominal wounds, compound skull fractures and other compound fractures.

This is because the drug reaches the zone of infection or injury promptly and in the maximum concentration. The effectiveness of the drug is clearly evident within 24 hours; if the course of the disease has not been influenced in that time further administration of it is likely to be useless. A smaller total amount of the drug will accomplish results in a shorter period than when sulfathiazole is administered by mouth, thus reducing the likelihood of toxic reactions.

6. It is not to be construed that the use of the sulfonamides locally is herein deprecated nor that their use orally should be discontinued. It is simply urged that in those diseases and injuries in which we are in a time race with infection the drug should be used intravenously initially or for the first few doses. If the prognosis is at all grave this route is preferable for use until the infection is well controlled or the patient is out of danger.

7. An initial favorable response to sodium sulfathiazole administered intravenously does not preclude the continued search for an

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accurate diagnosis in a patient in whom the diagnosis has not yet been established; on the other hand the lack of a favorable response is strong evidence that the causative agent is not an organism affected by sulfathiazole, this in contrast to the rather equivocal conclusions when the drug has been administered orally.

8. As in all sulfonamide therapy regardless of the route by which the drug is administered:

a. The fluid intake must be maintained.

b. The urinary output must be measured and recorded.

c. The blood picture must be studied if the drug is continued for more than 48 hours.

d. The value of the sulfonamides is such that if circumstances make it impossible to observe any or all of these precautions, as in the field, they should be reluctantly disregarded.

NOTE.—Since this paper was submitted for publication further evidence of the absence of crystalluria has been obtained. In one instance the simultaneous oral and intravenous administration of sulfathiazole was accompanied by an abundance of crystals in the urine. When the oral administration was discontinued, the crystals disappeared from the urine even though the drug was being administered in a dose of 1 gm. every 4 hours.

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SULFONAMIDE PATCH TESTS

Two hundred and thirteen men were patch tested with 10-percent ointments of sulfanilamide, sulfathiazole, sulfapyridine, sulfaguanidine and sulfadiazine. Patch tests were allowed to remain for 48 hours before being observed. Forty-three men were transferred before the 48 hours were up and no readings were made; this left a total of 170 men tested and observed.

Positive reactions were obtained on 10 men for a percentage of 5.8. One man was sensitive to both sulfathiazole and sulfapyridine. Reactions for the different drugs were as follows:

	No. sensitive	*Percent*
Sulfanilamide	0	0.0
Sulfapyridine	5	2.9
Sulfathiazole	5	2.9
Sulfadiazine	0	.0
Sulfaguanidine	1	.58

—HIRSCHFELD, H., Lieutenant (MC) U. S. N. R.

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LABORATORY AND FIELD STUDIES OF GLYCOLS AND FLOOR-OILING IN THE CONTROL OF AIR-BORNE BACTERIA

THE PERSONNEL[1]
of
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Recently much attention has been accorded the role of air-borne microorganisms in hospital cross infections and wound contamination (*1*) especially with regard to the need for control of air contamination under the crowded, emergency, and often inadequate conditions of hospitalization in wartime (*2–6*). British workers have demonstrated that certain light oils used as dust holders on blankets and floors markedly reduce air organism counts, with a resultant decrease in the incidence of intra-ward infections (*7–15*). Robertson and coworkers in this country have shown that certain glycols vaporized in minute concentration give practical sterilization of air heavily contaminated with any of a variety of common disease pathogens (*16–23*). Using this technic, Harris and Stokes obtained statistically significant reduction in the incidence of respiratory infections in a children's convalescent home (*24*).

The application of these methods to the practical control of air-borne disease, as it occurs in certain Naval establishments, has been the basis for investigations conducted in our laboratories and in a U. S. Navy Dispensary respiratory disease ward. The experiments presented herewith deal with field investigations involving floor oils and glycol vapor technics, and with laboratory experiments on glycol condensates, dew points, and air turnovers undertaken to clarify these field technics. Other aspects dealing with the interrelations of humidity and temperature as they affect bacterial popula-

[1] The Unit Personnel consists of: Capt. A. P. Krueger (MC) Officer in Command; Lt. H. W. Bischoff (MC); Lt. A. H. Jacobs (MC); Lt. Comdr. L. E. Rosenberg, H–V (S); Lt. Comdr. N. S. West, H–V (S); Lt. O. J. Golub, H–V (S); Lt. J. R. Mathews, H–V (S); Lt. H. M. S. Watkins, H–V (S); Lt. (jg) A. J. Glazko, H–V (S); Lt. (jg) G. B. Saviers, HC–V (S); Lt. (jg) M. D. Thaxter, HC–V (S); Ens. W. R. Lief, HC–V (S); Pharmacist I. L. Shechmeister, HC–V (S); Pharmacist A. I. Teplow, HC–V (S); Chief Pharmacist's Mate W. L. Axelrod; Pharmacist's Mate, first class, H. R. Burkhead; Pharmacist's Mate, first class, C. R. Webb, Jr.; Pharmacist's Mate, first class, W. D. Won, all of the United States Naval Reserve.

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tions, and a dynamic air-flow apparatus for such studies, are described elsewhere (*25*).

PRELIMINARY LABORATORY EXPERIMENTS

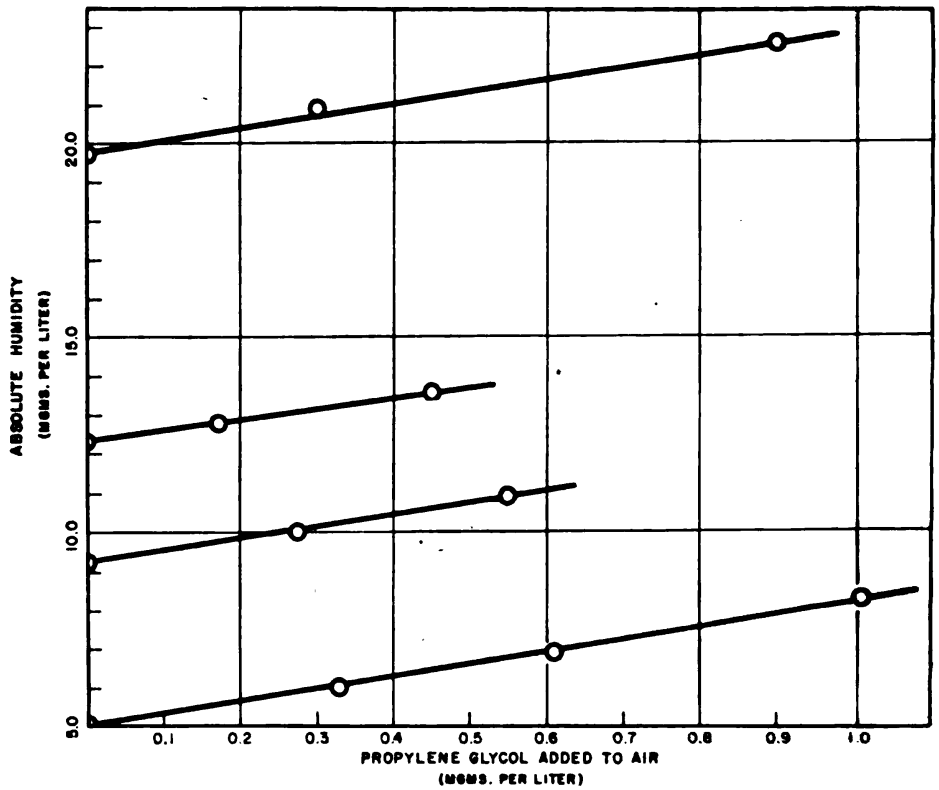
Pilot experimental runs in the ward indicated that violent fluctuations in glycol concentrations and bacterial counts would be regularly encountered. These necessitated a number of laboratory experiments to investigate factors affecting air turnovers and the distribution of glycol vapor in a room, as well as certain physical properties of glycol-water vapor mixtures. These experiments are presented now in order that their application to the subsequent description of field investigations may be more readily grasped.

1. *Effect of glycols upon the dew point of air.*—The bactericidal efficacy of glycols varies markedly with changes in temperature and in humidity (*23*) (*25*), decreasing rapidly with temperature rise, and reaching a maximum between 40 percent and 60 percent relative humidity (RH). In studying the latter condition, we observed that the introduction of a glycol into air produced a rise in the dew point. This phenomenon was investigated further with the view of obtaining data which might elucidate the hypothesis that glycol lethal action may be due in part to a condensation in high concentration of hygroscopic particles (*23*).

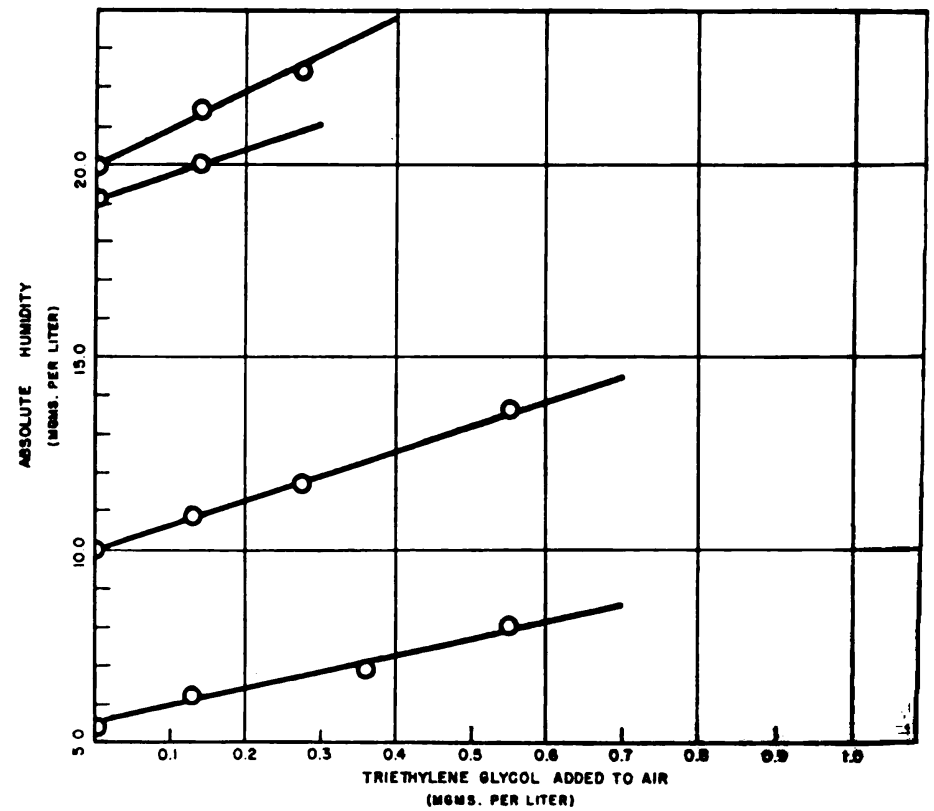
Two series of experiments were performed respectively in a small, glass-front metal chamber (1.5 cu. ft. volume), and in a large metal lined box (210 cu. ft. volume) fitted with a gasketted door and a 12-inch square window. Both chambers were equipped with: (a) Suitable electric fans; (b) an "Air-guide" hygrometer; (c) a thermometer graduated in tenths of a degree Centigrade; (d) a glycol dispenser consisting of a clockwork-operated syringe (*20*) feeding through a needle piercing a rubber port onto a piece of asbestos, wrapped with heated chromel wire; and (e) a Regnault-type dew-point hygrometer operated and cleaned entirely from outside the chambers. In addition, the large chamber was equipped with a thermostatic control, a Taylor wet-dry bulb psychrometer, and an air-sampling atomizer (*25*).

Dew-point readings were obtained by averaging the temperatures at which dew successively appeared and disappeared on the polished metal surface of the Regnault hygrometer. In the presence of glycols, two separate dew points could be distinguished readily with propylene glycol (PG), but with difficulty with triethylene glycol (TEG): (a) A very thin film of condensate first appeared, probably consisting chiefly of glycol, as it evaporated much more slowly than pure water when the temperature was elevated; (b) a much heavier condensate appeared as the temperature approached the true (water) dew point. This dew probably contains a higher percentage of water than the condensate in (a). All experiments with the small chamber were made using the

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1. Effect of propylene glycol vapor on apparent absolute humidity as calculated from dew-point observations.



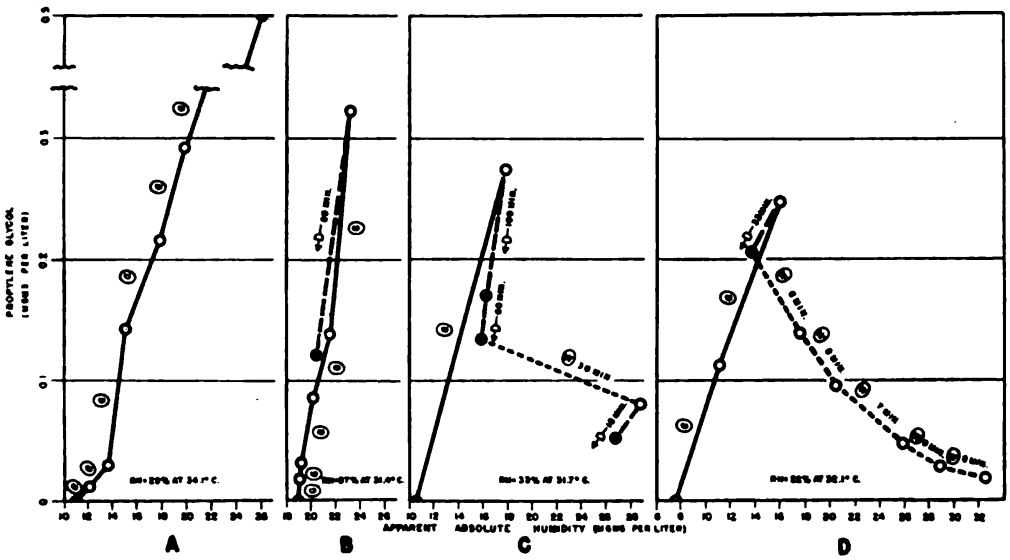
2. Effect of triethylene glycol vapor on apparent absolute humidity as calculated from dew-point observations.

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heavy dew (b) end point; however, in the large chamber the light dew (a) end point was chosen so that large changes could be observed. Results from both end points were readily reproducible.

Pilot experiments in the small chamber were performed by introducing known amounts of water-free glycol (PG or TEG) into the chamber at different known humidities, and determining the resultant dew-point temperatures. In this manner a rough correlation was established between glycol concentration, the true dew point, and the glycol-elevated dew point. A summary of such data, expressed in terms of absolute humidity (AH) as calculated from observed dew points, is presented in figure 1 and figure 2. Repetition of these experiments in the presence of $CaCl_2$ or concentrated H_2SO_4 nullified the anticipated rise in dew point. It is probable that the drying agent absorbed both glycol and water vapor until equilibrium was again established.

Experiments in the large chamber employed PG only, the glycol being vaporized into a known volume of air at known humidity and temperature under conditions permitting increases at will in PG concentration or humidity. Dew points and relative humidities were observed and the actual PG–air concentrations were obtained by chemical analysis (vide infra). Results are presented in table 1 and in figure 3.



3. Effect of water vapor on apparent absolute humidity in the presence of glycol vapor.

A. Effect of glycol concentration on the apparent dew point, in terms of absolute humidity.

B. "Dieaway" of glycol-vapor concentration.

C. Effect of water vapor on the glycol concentration in air.

D. Effect of water vapor on the glycol concentration in air.

Ⓖ Glycol added.

←D— "dieaway" period.

Ⓦ Water added.

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Experiment A (table 1 and fig. 3) presents a series of measurements of dew points and PG concentrations following the additions of successive increments of PG vapor to the system. Increases in the AH (calculated from the dew point) appear to be directly proportional to the concentration of PG, amounting to an apparent increment of about 30 mg. of water for each mg. PG present. The apparent RH increase is from an initial 29 percent to a maximum of 68 percent in the presence of 0.5 mg. PG per liter of air.

TABLE 1.—*Effect of propylene glycol vapor on dew point*

Experiment	Glycol concentration mg./l	Room temp. °C.	Dew point °C.	Apparent percent RH from dew point	Apparent AH from dew point	Percent RH from wet-dry bulb
A						
No glycol present	0	34.1	12.6	29	11.0	
Glycol added	.012	34.1	14.0	32	12.1	[1]
	.028	34.1	14.8	34	12.7	
	.058	34.1	16.0	36	13.7	
	.152	34.1	17.6	39.5	16.0	
	.217	34.1	20.5	47.5	17.6	
	.292	34.1	22.3	52	19.8	
	.502	34.1	26 - 28	68	26.0	
B						
No glycol present	0	31.4	21.7	57	19.0	59-
Glycol added	.018	31.4	21.8	58	19.2	59
	.032	31.5	21.9	58.5	19.3	59-
	.085	31.5	22.7	61	20.2	59
	.138	31.5	23.8	65.5	21.5	59
	.322	31.5	25.2	70.5	23.2	59
60-minute "dieaway"	.131	31.5	23.0	60.5	20.6	59-
C						
No glycol present	0	31.7	12.1	33	10.7	37
Glycol added	.277	31.7	20.5	54	17.8	56
100-minute "dieaway"	.170	32.8	19.0	46	16.3	49
60-minute "dieaway"	.134	32.5	18.5	45.5	15.8	49
Water added	.081	33.2	29.0	80	28.8	80
16-minute "dieaway"	.051	33.0	27.5-28	75	26.8	75
D						
No glycol present	0	32.1	6.7	22	7.6	.....
Glycol added	.115	32.1	12.8	33	11.2	.....
	.247	32.1	18.7	47	16.0	.....
33-minute "dieaway"	.206	32.1	16.1	41	13.7	40
Water added during 6 minutes	.138	33.3	20.3	49	17.6	45
do 8 do	.095	33.6	23.0	56	20.6	57
do 7 do	.047	33.8	27.0	69	25.8	69
do 9 do	.028	34.2	29.0	76	28.7	78
do 8 do	.018	33.8	31.3	87	32.5	83

[1] No readings taken.

Experiment B presents a similar series in which the apparent RH increases less rapidly, presumably because of a higher initial concentration of water vapor in the system. An 80-minute "dieaway" period resulted in a sharp drop in glycol concentration with a final dew-point reading superimposed on the original glycol vs. dew-point curve. Accordingly, the system appears to be unstable, and glycol-water mixtures take an appreciable time to condense; further, the possibility is indicated of predicting glycol vapor concentration from measurements of dew-point and true water-vapor concentration, as obtained respectively from the Regnault-type hygrometer and from wet-dry bulb readings.

Experiment C is a repetition of (B) with successive "dieaway" periods of 100 minutes and 60 minutes, followed by vaporization of 75 cc. of water in the chamber during a 30-minute period, and then by a third 16-minute "dieaway". The additional water vapor materially increased the extent of PG "dieaway" during the time interval noted. The slight variation in temperature was due to heat produced by the vaporizing unit; however all calculations were based on the exact air temperature at the moment of dew-point observation.

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Experiment D repeats experiment (C), the indicated 33-minute "dieaway" period being followed by the addition of increasing amounts of water vapor at 6- to 9-minute intervals during a total elapsed time of 38 minutes. It is evident that the decrease in glycol concentration is roughly proportional to the degree of air saturation with water.[2] This supports the observations of Puck et al. (*23*). Likewise the equilibrium values for PG obtained after "dieaway" periods (figs. 3B and 3C) fall fairly close to the curve shown in figure 3D when plotted against AH, indicating a slow but definite return to equilibrium from conditions of "supersaturation."

2. *Determination of air turnovers.*—Several methods of determining air turnovers[3] were studied in the laboratory. Two of them subsequently were used in a number of the ward runs to predict glycol vapor concentrations from the measured output of the vaporizer and the volume of the room. These methods measure the rate of removal of some tracer substance on the logical premise that air removal occurs at the same rate (*26*).

Whenever fresh air is introduced into a room containing a foreign vapor, or dispersoid phase such as dust or bacteria, a certain amount of the foreign substance will be removed. Assuming (a) perfect mixing of the incoming air with the room air, and (b) a uniform rate of ventilation, the rate of decrease in concentration of tracer substance is proportional at any given time to the concentration of the tracer substance in the room air; i. e.,

$$-dN/dt = kN \qquad (1)$$

or, on rearranging and integrating,

$$K = 60k = \frac{60 \times 2.3 \log (N_1/N_2)}{(t_2 - t_1)} \qquad (2)$$

where:

k = turnover rate per minute

K = turnover rate per hour
t = time in minutes
N_1 = concentration of tracer substance at time t_1
N_2 = concentration of tracer substance at time t_2

According to this formulation, about 63.2 percent of the original amount of tracer substance would be removed by a single turnover of air leaving 36.8 percent behind in the room.[4]

In order to simplify the use of equation (2) a graphic method was devised for determining the number of air turnovers. In figure 4 the concentration of gas or vapor in the air, expressed in percent, is plotted on a log scale against time on an arithmetic scale. A straight line results for a constant turnover rate. Therefore if a given amount of CO_2 or PG vapor is introduced into a room and an analysis made for the concentration at any given moment, and again a definite number of minutes later, the percentage reduction in concentration and the elapsed time afford sufficient data for determining the turnover rate. For example if the concentration falls off 50 percent in 10 minutes, the number of air turnovers is found to be approximately 4 per hour, using either figure 4 or equation (2) for the computation.

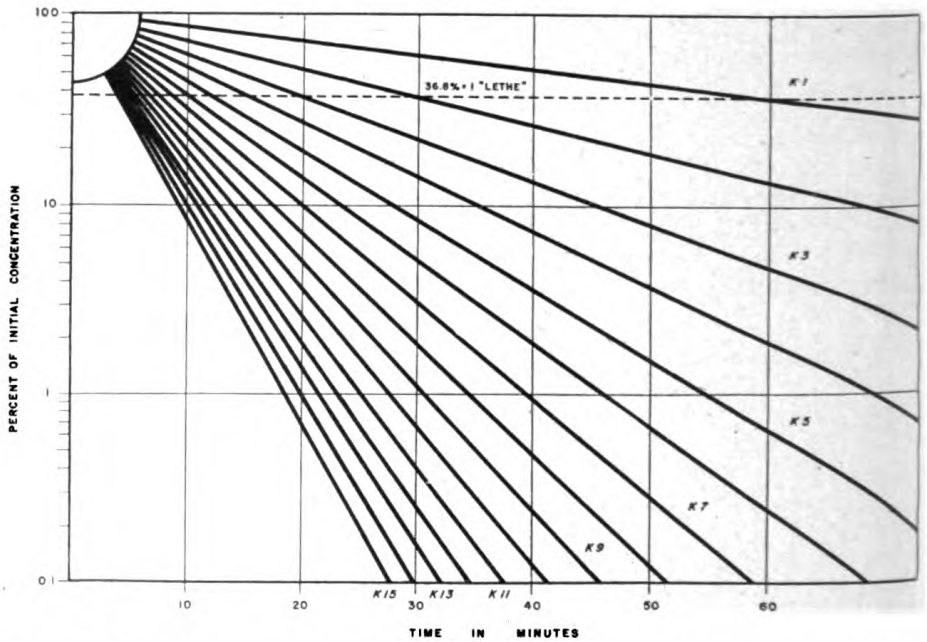
[2] 100 percent RH at 34° C. = 37.6 mg. water per liter of air.

[3] The term "turnover" is taken to mean the introduction of a volume of air into a room from the outside, equal to the total volume of the room; the displaced air leaving the room is a mixture of the two.

[4] This is the basis for Wells' definition of a "lethe" which represents the intensity of ultraviolet light or the concentration of bactericidal agent required to reduce the bacterial count of the room air to 36.8 percent of the initial value (27) (fig. 4).

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A number of experiments were performed in a room containing 2,000 cubic feet of air (corrected for the volume of desks and cupboards) and having a single ventilator near the ceiling. About 10 cubic feet of CO_2 were released from a cylinder into the closed room. Several fans were installed to mix the gas thoroughly with the room air. At "zero" time a sample of room air was taken with a 50-cc. gas sampling bulb. Additional samples of room air were taken several minutes later, only a few seconds being required to take each sample. The total CO_2 in the air samples was determined with a Haldane gas analysis apparatus, and the turnovers calculated from equation (2). If the CO_2 present in the incoming air represents an



4. Chart for the determination of air turnovers from the "dieaway" of a tracer substance.

appreciable fraction of the CO_2 in the room, the concentration of CO_2 in the incoming air should be subtracted from N_1 and N_2 in order to get accurate results. The method is convenient for small rooms, but the quantity of CO_2 required for large rooms or for well-ventilated rooms may be too great to be practicable.

The "dieaway" rate of PG vapor can be used as an index of air turnover in much the same manner as has been described for CO_2, except that our method of sampling the air for glycol requires several minutes, during which time the concentration of glycol vapor diminishes. For accurate results, it is therefore necessary to integrate over the whole time interval of sampling in order to determine the true concentration at any given time during the collection period.

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However when the turnover rate is less than 10 per hour, there is little loss in accuracy if the glycol content obtained in a sample collected for several minutes is taken to represent the actual glycol concentration at the midpoint of the collection period. Consequently when the collection periods are of equal length, it is permissible to measure the time interval between the start of each sampling period as a measure of the elapsed time between samples.

In actual practice the glycol vaporizer is turned on for a sufficient length of time to build up a glycol concentration in the room. The vaporizer is then turned off and either covered to prevent the escape of more vapor, or the whole unit is removed from the room. The sampling atomizer is started and allowed to run for several minutes. The wash water (25 cc.) is removed, the atomizer rinsed and refilled. A second air sample is then collected for the same length of time. The time interval between the samples is taken as the difference between the time of starting each collection period.

The use of PG for turnover measurements involves the assumption that the "dieaway" is entirely due to venting, and not in part to factors such as condensation of the vapor. While condensation often occurs, inspection of "dieaway" data listed elsewhere in this paper (fig. 3) indicates the error to be of little importance provided that the two samples for "dieaway" measurement are taken within a few minutes.

The phenomenon of a glycol-induced rise in dew point can be used with PG (but not with TEG) to measure turnovers in the same manner as that described above.

Inspection of accumulated data from the first few ward runs indicated that the rate of subsidence of bacterial counts following a marked disturbance is also adequately described by equation (1). This method of turnover measurement was especially useful during TEG runs, since at the time they were made no satisfactory method for microchemical titration was available.

3. *Glycol distribution within a room.*—In order to measure in the laboratory the effect of obstructions, air current turbulence and settling on the distribution of vapor, we attached a vertical series of sampling atomizers at different elevations to a portable frame 10 feet high, and operated them at different spots within a room in conjunction with another control atomizer operated under identical conditions at a fixed spot. The room employed had 3,700 cubic feet net unobstructed volume with 96 square feet window surface; it contained large tables, desks and cupboards and had between 1 and 2 turnovers per hour. Under strictly comparable conditions with the PG vapor concentration held constant at 0.14 mg. per liter of air (1:7 million[5]) calculated output, we recovered concentrations at the same elevation in different parts of the room varying between 0.25 mg. (1:4 million) and

[5] (1 : 7 million) = 1 gm. PG vapor in 7 million cc. of air.

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0.14 mg. (1:7 million) per liter of air and at different levels in the same part of the room between 0.25 mg. (1:4 million) and 0.13 mg. (1:8 million) per liter of air. Room temperature was held constant at 76° F. and the RH at 60 percent. The percentage of PG calculated output recovered by different sampling atomizers was approximately the same, and ranged from 15 percent of PG concentration calculated at 0.04 mg. (1:25 million) per liter of air to 35–40 percent at a concentration of 0.5 mg. (1:2 million) per liter of air. These low recoveries are attributed to the fact that one side of the room was largely window area, and provided an admirable surface for rapid removal of PG by condensation.

FIELD INVESTIGATIONS

These experiments were all carried out in a single dispensary ward with a minimum of interference with normal ward routine.

METHODS

1. *Description of experimental ward and pertinent ward routine.*—Experiments were carried out in a rectangular ward, 36 feet long, 24 feet wide, and 10 feet high, the long axis providing a westerly exposure through two double sash windows approximately 36 square feet in area. A steam radiator was located beneath the windows, which were opened as needed to adjust room temperature. The chief air current, as determined by tobacco smoke observations, led directly from the windows into a corridor through a door centered in the opposite wall. A second door, usually kept closed, was centered in the north wall and led to a small utility room and thence to another similar ward. The only mechanism for ventilation control other than windows and doors was provided in the ceiling by two wire gauze covered vents, 12 inches by 24 inches, leading into a tremendous attic space many times the ward volume. These were blocked with paper covers during experimentation. The floor was built of varnished pine, well worn; the walls were pine and composition board, and the ceiling composition board. Temperature and humidity showed the following limits of variation: 66° F. with 41 percent RH; 87° F. with 45 percent RH; 72° F. with 37 percent RH; and 80° F. with 58 percent RH. It should be noted that these encompass the range of maximum glycol effectiveness. Variation in temperature or relative humidity was greater than 10° F. and 5 percent RH in only three of a total of 42 runs.

During the period of experimentation the numbers of ward patients ranged from 8 to 27, averaging about 12, except during one month when administrative changes required housing 21 to 27 patients in double-tier bunks under conditions of severe overcrowding. Case histories chiefly listed acute respiratory conditions; however, fractures and miscellaneous chronic infections were occasionally present. The transiency of the patients prevented observations on the incidence of intra-ward infections.

The following points in the ward routine were pertinent to the experiments: Early breakfast was followed by sweeping and bed making by ambulatory patients, this phase usually being completed by 0830. Admissions, doctors' rounds, etc., occurred between 0900 and 1100. Lunch was brought to the ward on trays by ambulatory patients at 1130. Miscellaneous minor activity was often noted before 1330, following which the ward became progressively quieter until 1430 when experimental runs usually had been completed. This routine

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was modified on the weekly inspection day by marked morning activity and by water-swabbing of floors following the usual sweeping with a push-broom. The routine occasionally was further modified to suit experimental needs by substituting an early afternoon sweeping period for the customary morning period, or by conducting a midmorning simultaneous bed-making period.

2. *Counts of air-borne microorganisms under control and experimental conditions.*—A Bourdillon slit sampler (*28*), adjusted to pass 1 cubic foot of air per minute, was used to sample the bacterial content of 1 to 10 cubic feet of air, the volume depending upon the numbers of organisms expected and the media employed. Collected organisms were impinged directly on the surface of 5-percent horse blood nutrient agar plates, or, for selective hemolytic bacterial counts, on the same medium containing 1:500,000 gentian violet (*29*). Air samples were collected hourly or oftener during a normal day's run lasting 7 hours. In addition samples were taken immediately following any unusual or identifiable disturbance in the ward. A control series was made the day immediately prior to a run and also immediately prior to the treatment itself, to insure that previous treatments no longer affected the expected counts.

In this manner data were obtained for (a) a base line "total" bacterial count, (b) an air-borne streptococcus count, (c) a "total" hemolytic bacterial count, and (d) a hemolytic streptococcus count. Counts were obtained from the ward in an identical manner after treatment with chemicals or oil. Throughout an experimental run detailed records were made of the exact time and place a plate was exposed and the time and nature of any occurrence which might be expected to yield a count greater than the base line.

A total of 118 hemolytic colonies was picked onto blood agar slants from 41 plates taken during 28 runs. Colonies were chosen by descriptive and hemolytic characteristics with the object of demonstrating recovery from ward air of all types of hemolytic streptococci and of coagulase positive and mannite fermentation positive hemolytic staphylococci (*30*). Pour plate hemolytic characteristics as determined under a dissecting microscope (*31*), plus observations of morphologic and gram-stain characteristics, gave a check identification of isolated strains.

3. *Application of floor oil.*—Counts were made the day prior to oiling the ward, particularly before and after sweeping, to check base levels of air contamination. The floor was then thoroughly swept and swabbed with water. No other preparation was made. The following morning the floor was routinely swept with a dry push-broom, then thoroughly swabbed with a mop liberally soaked in a light mineral oil,[6] using about one gallon for the ward (864 sq. ft.). In 4 hours the floor was no longer excessively slippery, and in 24 hours it appeared "dry." For 5 successive days counts were made before and after the morning sweeping period; thereafter counts were made only on each third day until the effect of the oil on the counts was no longer apparent. Then a second oil application was made with no floor preparation other than dry sweeping, and counts were repeated.

4. *Mechanics of glycol dispersion and control.*—Water-free propylene glycol (PG) and triethylene glycol (TEG) were vaporized separately into the ward by means of the field dispenser developed in this laboratory (*32*). Glycol output was controlled by maintaining the temperature of the liquid at a previously determined level, thereby producing concentrations up to saturation.[7] The

[6] The oil chosen approximates that used by the British (*9*) in its specifications. Shell "Maxim" #22; flash point 182° C.; viscosity 50 centistokes at 20° C.; specific gravity 0.865.

[7] At 25° C. and 50 percent RH, air saturation for PG = 0.35 mg. per liter of air (1:3 million); for TEG = approximately 0.005 − 0.004 mg. per liter of air (1:200–250 million) (*23*).

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dispenser was mounted 7 feet above floor level directly in front of the windows. A 10-inch fan mounted behind the dispenser dispersed the current of vapor into the ward; two similar fans mounted in front of the dispenser were directed so as to disperse upward and to churn the vapor-air current. In PG runs the calculated output concentration was further checked against actual air-borne glycol content as recovered in an air sampling device. Experiments utilizing TEG, performed subsequent to PG runs, were conducted under conditions of air "supersaturation" with glycol as judged by visible "fogging" throughout the ward.

5. *Chemical titration of air-glycol mixtures.*—Prior to and repeatedly during runs, the PG content of the air was measured by washing air samples through an atomizer, modified from a design by Wells (*33*), containing 25 to 50 cc. of distilled water. Sampling atomizers were operated for 5 minutes at a negative pressure of 15 cm. mercury and at an air-flow rate of 9 liters per minute (0.32 cu. ft.) measured with a gas meter. Aliquots containing between 0.3 and 1.0 mg. PG per 10-cc. sample were subsequently titrated by the periodate method (*20*).[8] It was found essential for accurate results to aerate in the atomizer the distilled water "blank" used in the titration. The rate of change in PG concentration, determined by titrating rapid successive samples taken immediately after cessation of PG vaporization, was also used to calculate approximate air turnovers (vide supra). Samples taken for the purpose of routine correlation with bacterial counts were obtained in the middle of the ward, 4 feet above floor level, with the sampling atomizer within 2 feet horizontal distance of the slit sampler intake.

OBSERVATIONS

1. *Bacterial counts in the normal ward.*—Great fluctuations in the air bacterial content occurred repeatedly during a day's run under conditions of normal ward routine, the variations depending on types and degrees of ward activity. Table 2 presents data typical of such a run. The difficulty of making comparisons to establish "base lines" under conditions subject to such variation is apparent; accordingly no attempt was made to establish true statistical control of experimental and "normal" runs for any given hour or sequence of time intervals. Instead the air count for the "quiet" ward[9] has been established, and other counts listed according to their occurrence in conjunction with events which materially affect this "quiet" count. The degree that such selection is subject to personal bias is recognized, but felt justified as long as strict numerical comparisons are not used as bases for quantitative conclusions.

[8] A new method involving oxidation with ceric sulfate was developed during the course of this work, but was found to be less convenient than the periodate method.

[9] The lowest counts obtained uniformly occurred in the period between 1330 and 1430; this was taken as representative of "quiet" ward levels.

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TABLE 2.—*Typical data sheet for a ward run*

ır	Plate No.	Total count		Hemolytic count		Ward		Glycol: PG				Comments
		24 hr.	48 hr.	24 hr.	48 hr.	Temperature °F.	RH%	Temperature °F.	No.	Mg.	Mg./l	
8	1bl	sp				75	45					Ward swept 0830.
2	2gv	17	21	10	14							
2	3bl	164		2								
5	4gv	17	17	10	10							Beds made at will.
5								75	1	0.00	0.00	PG turned on. Rounds being made.
4						75	45	140				
7								161				
1						77	46	185				Fans turned on.
0						78	46	187	2	1.22	.07	Ward uncomfortable, sweet taste in throat.
0	5bl	161	sp	0				187	3	1.58	.09	
3	6gv	31	42	3	20							Men up for mess.
5						80	46	189	4	1.86	.10	
8						82	45	189	5	2.58	.14	4 visitors in ward for 5 minutes.
7	7bl	114	163	1	d							Ward fogged: 1210.
0	8gv	17	23	3	4							
0						84	45					Swept deck, unusual amount of dust.
1	9bl	±600		±23								
4	10gv	29	41	11	18							
5						84	45	189	6	2.87	.16	
0												Bed made near Bourdillon sampler.
3						84	46	183	7	2.50	.14	PG off and covered.
5	11bl	136	sp	2					8	.62	.03	
0	12gv	15	22	2	d	84	44		9	.38	.02	
5												Side door opened for 5 minutes.
2									10	.16	.01	Ward more comfortable.
5						81	44					Windows open 6 inches.
3	13bl	44	48	1	d							
5	14gv	1	14	1	4							

3–16–43. 18 men. Cubic feet of air: bl-2, gv-10. PG-Air samples: Atomizer #9, containing
ed water, 2 min. at 15 cm. Hg.
agar plate. gv: Gentian violet blood agar plate. sp: uncountable because of "spreading"
ncountable because of diffuse hemolysis. RH%: Percent relative humidity. PG: Propylene
: Number of mg. of PG vapor recovered in wash water sample. Mg./l: Number of mg. of PG
ined in one liter of air.

mmary form, such accumulations are presented in table 3.
nts causing marked count increases, in order of importance
) Sweeping; (b) early morning activity; (c) bed making;
) the meal period activity. Although not indicated here, it
said that any sort of activity caused a rise; further, that
counts rose roughly in ratio to the number of patients in
d, probably more as a result of increased activity than of
d organism output. Other disturbances which less uniformly
marked increases were: (a) Visitors; (b) preparation for
on; (c) new admissions.

TABLE 3.

A. Mean counts[1] obtained in the normal and treated ward					B. Statistical significance of difference between two means		
Item No.	Type of count and when taken	No. of runs (N)	Mean[2] count ($\bar{x}$)	Standard deviation of the mean ($\sigma\bar{x}$)	Item nos. of two means	Standard deviation of the difference of two means $\sigma(\bar{x}a-\bar{x}b)$	Difference of two means divided by the standard deviation of that difference $\frac{\bar{x}a-\bar{x}b}{\sigma(\bar{x}a-\bar{x}b)}$
1	Total, morning, before sweeping.	5	157	24	2-1	99	2.2
2	Total, morning, after sweeping.	7	373	82	3-4	124	3.6
3	Total, afternoon, before sweeping.	5	53	16	1-7	17	7.6
4	Total, afternoon, after sweeping.	7	502	102	2-7	64	5.2
5	Total, bed making	5	317	102	3-7	11	2.6
6	Total, midday meal period	8	102	21	4-7	83	5.7
7	Total, "quiet" ward	11	27	3	5-7	70	4.1
					6-7	18	4.2
8	Streptococcal,[3] morning, before sweeping.	2	4	1			
9	Streptococcal, morning, after sweeping.	4	36	12	9-14	7	5.0
10	Streptococcal, afternoon, before sweeping.	4	1[4]	1	11-14	10	5.0
11	Streptococcal, afternoon, after sweeping.	4	48	19	12-14	1	5.4
12	Streptococcal, bed making	4	8	2			
13	Streptococcal, midday meal	5	1	1	1-15	29	4.4
14	Streptococcal, "quiet" ward	7	1	1	3-15	20	1.3
					2-16	99	3.5
15	Total, oiled floor, before sweeping.	4	28	10	4-16	121	4.0
16	Total, oiled floor, after sweeping.	5	24	5	7-16	5	0.6
17	Total, PG-treated, before sweeping.	3	73	18	18-17	75	2.1
18	Total, PG-treated, after sweeping.	3	228	72	3-17	24	0.8
19	Total, PG-treated, midday meal.	4	77	25	4-18	171	1.6
20	Total, PG-treated, "quiet" ward	2	21	2	6-19	34	0.7
					7-20	7	0.9

[1] Counts represent number of bacteria per cubic foot of air.
[2] All statistical measures calculated using formulae for small numbers of samples.
[3] Counts of colonies of hemolytic streptococci.
[4] Mean counts of less than 1 were taken as 1 for purposes of statistical evaluation.

Table 3 indicates that the recovery of hemolytic streptococci also was subject to the effect of disturbances. Contrary to results that have been found in other structures subject to public gatherings (*34*), in this respiratory disease ward hemolytic streptococci did not decrease markedly during the late spring months. All three types of hemolytic streptococci were collected, about 4 percent being beta streptococci. Of 29 hemolytic staphylococcic colonies examined, one gave a positive reaction (4+) to both the coagulase and mannite fermentation tests, performed with suitable control strains according to the technic used by Flaum (*30*). His investigation indicates that a positive result from both these tests characterizes a staphylococcic strain with great surety as being of pathogenic origin.

2. *Bacterial counts in oil-treated ward.*—Swabbing the floor with water, PG, water-PG mixtures, or with oil, held down dust, the major

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source of rises in air counts; however only the oil was found to have adequate lasting qualities. Table 3 shows intermittent counts before and after sweeping over a 3-week period in an oiled ward. The first application held counts to "quiet" levels throughout the day for more than a week, and in considerable measure was still effective for over 2 weeks. The second application was completely effective for over 2 weeks. No contraindications of any sort were noted. The possibility of fire hazard we feel is not excessive under most circumstances with the oil used, which has a flash point of 182° C.[10] In passing, it may be noted that the head nurse of the dispensary, without knowledge of our experimental results, was so impressed with the change our oil experiment had created in keeping the ward dust-free that she requested a supply of oil from us for routine use in other wards.[11]

3. *Bacterial counts in glycolized ward.*—Samples from early runs using PG and TEG showed no bacterial reduction in the presence of either glycol. However to eliminate the possibility that our calculated and recovered glycol concentrations were inaccurate, later experiments were run with the air saturated with glycol vapor, as evidenced by "fogging" throughout the ward. Under such conditions the objectionable oppressive features (*22*) of these vapors were very marked; however even then sharp rises in bacterial counts resulted from marked disturbances as is indicated for PG runs in table 3. Whether there was a depressant effect on "quiet" levels is questionable; any effect on droplet-nuclei would be masked under the prevailing conditions in this ward in the absence of dust-settling measures. Further the normal fluctuation of the counts makes the small difference noted very likely only chance variation. If it is real it is minimal, and in our opinion expresses a result of no practical value to the control of bacterial dust.

COMMENT

1. *Laboratory experiments.*—In considering the possible mechanism whereby glycols under proper conditions "sterilize" the atmosphere, Robertson and Puck have advanced the hypothesis that glycol vapor in the air may cause condensation onto hygroscopic particles (including dust and bacteria) as well as onto the walls and surfaces of the room (*22–23*). This might result in (*a*) an increased rate of sedimentation of the particles, (*b*) retention of the particles on the walls and furniture of the room by the film of condensate on the exposed surfaces, and (*c*) a direct bactericidal action in the event of a sufficiently high concentration of glycol occurring in the condensate. Our

[10] Fire Underwriters consider this use of certain mineral oils having higher flash points than 125° C. (*36*) relatively nonhazardous. Such an oiled floor will not ignite more readily than a dry one; however it will support more readily a major fire already started.

[11] Oiling technics have also been reported effective on linoleum, but not on concrete floors (*9*).

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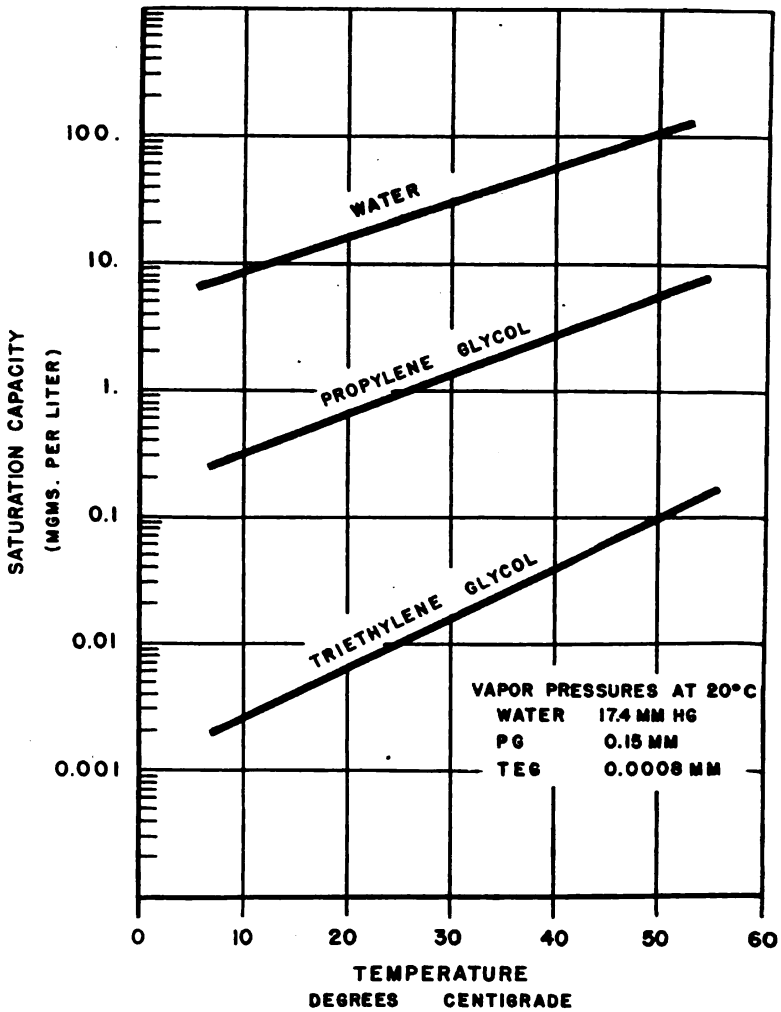
experiments in the test chambers furnish additional evidence in support of the theoretical considerations on which the lethal condensate hypothesis is based.

Whenever the concentration of a vapor exceeds the saturation capacity [12] of air, the excess vapor will condense to form a liquid. The condensation will occur more rapidly on hygroscopic nuclei than on ionic nuclei or in free space (*37*), at a rate influenced by the amount and type of surface available. The saturation capacity can be calculated from the following equation:

$$c = \frac{mm.\,Hg. \times 1333 \times MW}{R \times T} \qquad (3)$$

where: c=concentration of glycol in air (gm. per cc.)

$mm.\,Hg.$=vapor pressure in millimeters of mercury (at 20° C., PG=0.15 mm.; TEG=0.0008 mm.)



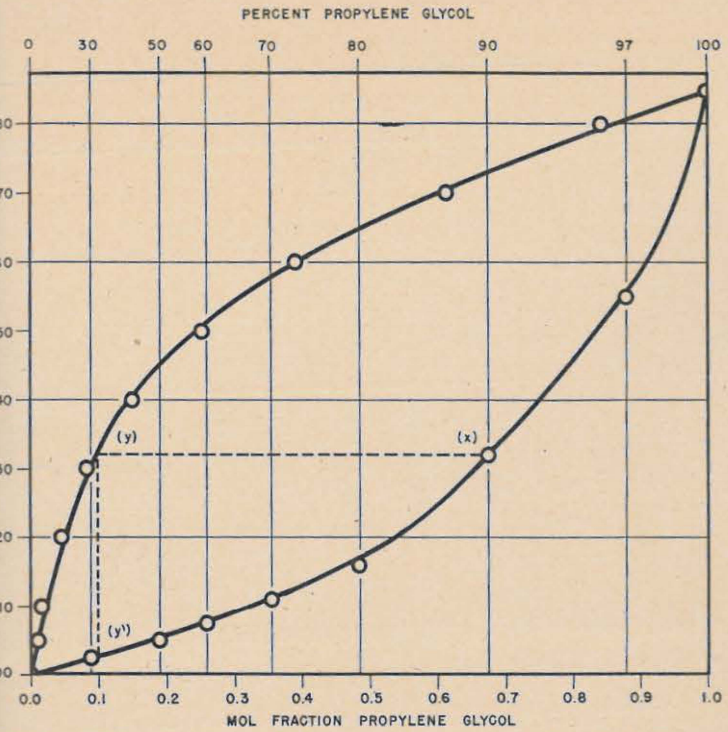
5. Maximum concentration of vapor in air at various temperatures.

[12] Saturation capacity is a term used to express the maximum quantity of vapor which can be held by a unit volume of air at a given temperature without supersaturation. It is equivalent to the absolute humidity at saturation (=100 percent relative humidity).

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MW=molecular weight of glycol (PG=76; TEG=150)
R=gas constant (8.3×10^7 ergs/°C./mol.)
T=temperature (degree absolute)

re 5 gives the saturation capacity for PG and TEG as calcu-rom equation (3). From these data one would expect dry e saturated with PG vapor at 20° C. when 0.62 mg. per liter nt (1:1.6 million). Any excess over this concentration would e as pure liquid glycol. In the presence of water vapor,



Boiling point-vapor composition curves for aqueous glycol solutions.

r, both the saturation capacity for glycol and the composition condensate would be expected to vary, as is indicated by D.

re 6 shows the range of boiling points of PG-water mixtures mm. pressure, together with the theoretical vapor composition A liquid mixture of composition (x) corresponding to 90

re 6 was plotted from figures based on the vapor pressure data given in the Carbide on Chemicals Corporation booklet on "Glycols" (1941). Boiling points of PG-xtures were estimated from the intercepts with the 760 mm. ordinate. The vapor-data were fairly close to theoretical values, permitting reliable estimates of the essure and mol fraction of glycol in the vapor phase over the aqueous solutions

percent PG would produce a vapor phase in equilibrium with the solution whose composition is point (y) (=30 percent PG); conversely, a vapor mixture corresponding to point (y) would condense to give a liquid of composition (x) during the initial stage of condensation. Total condensation of vapor would give a final condensate (y') having the same composition as the original vapor.

In order to estimate the approximate composition of the condensate which might be expected to appear under actual conditions, let us assume that a 0.2 mg. per liter (1:5 million) concentration of PG vapor is present in air at 30–50–80 percent relative humidity. Table 4 shows the ratio of PG to water under these conditions, together with the expected concentration of PG in the initial condensate.

The mol fraction[14] of PG vapor under actual conditions is very low due to its low vapor pressure and to the relatively high moisture content of air; but on referring to table 4 or to figure 6 it is seen that a vapor mixture consisting of 3.7 percent PG and 96.3 percent water will condense to form a liquid consisting of 54 percent PG and 46 percent water, assuming ideal conditions. The concentration of PG in the initial condensate is close to the minimum lethal concentration for bacteria, which is usually given as approximately 70 percent PG (*22*); accordingly it presumably is involved in the lethal action exerted by glycol vapors.

TABLE 4.—*Theoretical composition of propylene glycol condensate*

RH at 20° C.	H_2O mg./l	PG mg./l	Percent PG in mixture, e. g., 100 (0.2/5.4)	PG mol fraction in vapor	PG mol fraction in condensate	Percent PG in condensate
30	= 5.2	0.20	3.70	= 0.0090	0.22	= 54
50	= 8.7	.20	2.25	= .0054	.15	= 42
80	= 13.9	.20	1.42	= .0034	.10	= 32

The decrease in PG concentration in our test chambers during "dieaway" periods (figs. 3B, 3C, and 3D) could be accounted for only by ascribing it to condensation. Such condensation takes an appreciable time (fig. 3B), indicating that under continuous vaporization a condition of "supersaturation" may be maintained which will favor a slow continuous formation of a condensate containing a PG concentration higher than we have theoretically indicated for conditions of vapor equilibrium. The observation of maximal glycol lethality at humidities between 40 and 60 percent RH is supported by the data in figure 3D indicating agreement with other observations (*23*) that maximal glycol concentration can be obtained in dry air (decreasing to a zero value in water-saturated air), and by the theoretical calculations of the concentration of PG in condensate at different humidities (fig. 6).

2. *Ward experiments.*—There can no longer be dispute concerning the fact that a large proportion of hospitalizations are complicated

[14] Mol fraction is the number of mols of any one substance in a system divided by the total number of mols of all substances in the system.

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by the patients' acquisition of pyogenic organisms within the hospital (*2–6*). Such organisms are dispersed from a case or carrier by several routes, each of which calls for different remedial measures. The risk from contact infection can be minimized by intensification of aseptic technics already routinely practiced (*1*). Less universally recognized are the transmissal routes combated by air sterilization and dust retention.

It is becoming generally accepted that one natural habitat of pyogenic cocci is the human nasopharynx; that the cocci are emitted within protective droplets of varying size; that small droplets (less than 0.1 mm.) evaporate rapidly to droplet-nuclei which remain suspended for long periods; that large droplets settle out rapidly a short distance from their origin to form droplet-dust; that viable droplet-nuclei may survive for hours, perhaps days, and that organisms in droplet-dust may survive for days, perhaps weeks; finally, that viable droplet-nuclei and droplet-dust recoverable from air are fully virulent (*1*).

Glycols are highly effective experimentally against droplet-nuclei (*25*), and to a lesser degree against desiccated droplet-dust (*23*). What proportion of intra-ward infection may be traced to moist nuclei and what to dust still remains unknown. However, judging from the work of Harris and Stokes already mentioned (*24*), it would appear that under conditions favoring a minimal dispersal of droplet-dust and maximal control of glycol concentrations, this method of clinical air sterilization is effective and practical, even at concentrations approaching its effective limits as measured bacteriologically. This observation, if verified, might be put to practical use during short epidemic periods, even in structures not subject to adequate ventilation control, in conjunction with principles of sanitary ventilation as discussed by Wells (*38*). In any event, for the purposes of this investigation glycol-air sterilization appears to be effective under laboratory conditions but is not demonstrably effective from a bacteriologic standpoint under practical field conditions. What portion of this observed difference may be due to the protection of expelled organisms by mucoid materials remains to be evaluated.[15]

Dust retention measures are designed to withhold from circulation a very large proportion of the infectious particles emitted by the patient. It is our opinion that droplet-dust very likely presents the chief source of intercurrent infections under conditions found in barracks, mess halls or temporary hospital quarters. We have purposely applied our oil technics in a cruder, more haphazard fashion

[15] It should be noted that no attempt was made to measure glycol effectiveness in conjunction with oiling technics, a combination which might give a quite different bacteriologic picture.

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than did the British workers; yet from a bacteriologic standpoint this technic eliminated the droplet-dust route of infection dispersal.[16]

On the basis of the observations described above, and on the extensive evidence cited from the work of others in our recent review (*1*), we feel that from a practical and immediate standpoint the problem of reduction of pathogenic air contaminants may be approached on the premise of the occurrence of the following sequence of events leading to a large proportion of intra-ward infections:

(*a*) The ejection from a patient-source of relatively large, protected infective particles under conditions favoring localized high concentration, maximal survival, and maximal retention of virulence of the individual particle.

(*b*) The rapid settling or venting of particles to such an extent that those remaining air-borne are ordinarily in concentration below the infection threshold of neighboring patients.

(*c*) The survival of infective particles over such time periods as to permit high concentrations to be impinged on objects surrounding the patient-source.

(*d*) The repeated reintroduction of infective particles into air in numbers well over the infection threshold, under the stimulus of "normal" ward activities.

(*e*) The extension of infective areas by air turbulence throughout the ward and hospital.

(*f*) The infection of low threshold patients at considerable distances from the original patient-source.

We feel the most important link in the probable infection chain has been amply demonstrated to be *reintroduction* of particles into the air.

SUMMARY

Experiments are described dealing with technics of air sterilization by glycols and dust retention by oils as tested in a Naval hospital ward. Laboratory experiments are presented in which glycol distribution and methods of evaluating air turnovers within a room are investigated. Observations on the rise in dew point occasioned by the presence of glycol vapor in air, combined with theoretical considerations of the composition of the condensate, support the hypothesis that the lethal action of glycol is due to direct condensation on bacterial nuclei.

Total and specific air-borne bacterial levels are determined and utilized as measures of air contamination and as potential sources of intercurrent infections.

[16] Bacteria introduced into the air from bedclothes of course are not affected by floor oiling, but the fact that our data do not emphasize the importance of bed making as a source of bacterial dissemination should not be interpreted as minimization; these aspects of the problem are receiving independent consideration.

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An attempt is made to differentiate measures necessary to combat intercurrent infection spread by (*a*) contact, (*b*) droplet-nuclei, and (*c*) droplet-dust. A probable infection chain is suggested to explain infections originating in droplet-dust. Glycols under the conditions described are bacteriologically ineffective in controlling droplet-dust contamination of air; however this in no way predicates their action on droplet-nuclei or on the incidence of infections resulting therefrom. Under conditions of war hospitalization it is probable that droplet-dust is the chief source of intra-ward infections, but it is a source which may be cheaply and readily controlled by applications of suitable oils on floors. Oils for this purpose are entirely safe and unobjectionable except possibly under conditions of extreme fire hazard; their use could well become a routine sanitary measure.

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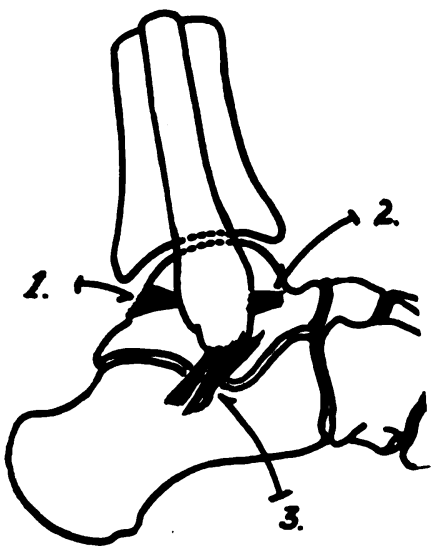
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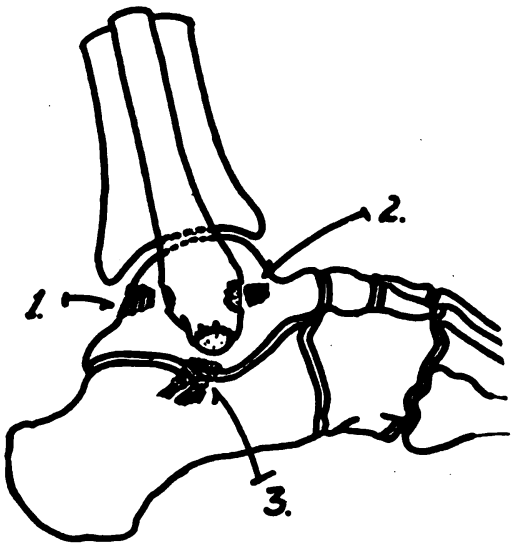
SPRAINED ANKLES

JOHN M. WRIGHT
Captain (MC) U. S. N. R.
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and
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Ankle injuries are commonly classified into fractures, dislocations, and sprains. If an injured ankle is x-rayed and no fracture or dislocation found, a diagnosis of sprain is usually made. It has been shown that in this x-ray negative group there may be as high as 20 percent with a severe ligamentous injury. A complete rupture



1. Schematic diagram of intact lateral ligaments: (1) Posterior talofibular ligament; (2) anterior talofibular ligament; (3) calcaneofibular ligament.



2. Schematic drawing of ruptured lateral ligaments of ankle. Rupture may occur at either end of ligament.

of the lateral ligaments of the ankle joint (anterior talofibular, calcaneofibular, and posterior talofibular) is not uncommonly found (figs. 1 and 2). These ligaments are necessary for free rotation and adduction of the talus. A similar injury rarely occurs to the medial ligaments. At the time this injury occurs the talus is rotated or adducts in the ankle mortise.

Although the dislocation is spontaneously reduced, swelling, muscle spasm and pain on motion usually prevent a diagnosis of rupture of the ligaments, without the use of an anesthetic. Under either

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general or local anesthesia, the foot can be passively adducted so as to put a stretch on the lateral ligaments and if they are ruptured, the talus will subluxate in the ankle mortise. An anteroposterior x-ray made with the foot held in this position is diagnostic (figs. 3 and 4).



3. Lateral, oblique, and anteroposterior x-ray of left ankle. No findings other than soft tissue swelling about external malleolus. Same patient as figure 4.

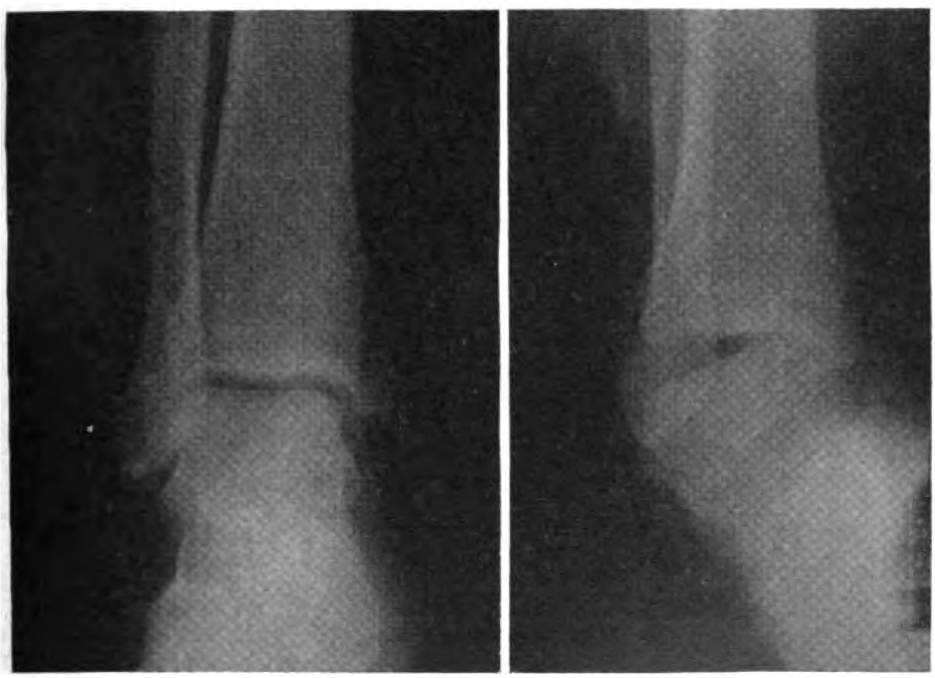


4. Both ankles forcibly adducted while x-ray was made. Left angle (figure at right) shows marked abnormal mobility of talus. Same patient as figure 3.

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In cases in which swelling is not too great, a diagnosis can frequently be made by palpating the anesthetized area of the talus distal and anterior to the tip of the lateral malleolus, while passively adducting the foot. If the ligaments are ruptured, the talus can be felt to rotate in the ankle mortise and the absence of the taut band of ligaments may be noted. Occasionally a sulcus can be distinguished at the ligamentous site of rupture.

Failure of these complete ligamentous ruptures to heal, due to inadequate immobilization, is largely responsible for chronic or recurrent sprained ankles, and for the common belief that a sprain may be worse than a fracture. Figure 5 shows a case diagnosed as a sprained ankle that was treated by procaine infiltration and early active motion by the method of Leriche.[1] After 6 years this patient was still disabled in walking on uneven surfaces and had frequent attacks of sprain associated with "giving way" or "turning," without any new violence. These symptoms are largely due to the instability of the ankle joint. The possibility of a flake of bone regenerating from periosteum avulsed at the origin of the ligament, forming a loose body in the joint, must be considered.



5. Anteroposterior x-ray, without and with adduction manipulation. Slight calcification about external malleolus noted in unmanipulated view. Twenty degrees adduction abnormal mobility when manipulated without anesthesia. No soft tissue swelling.

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The literature on sprained ankles treated by procaine infiltration and early mobilization uniformly comments on the lessening of symptoms and disability period. Within 11 months, besides 29 severely sprained ankles, 38 fractured ankles have been treated at this hospital, 21 of which were associated with the external malleolus.

When routine x-ray films were negative except for soft tissue swelling about the external malleolus, patients with severely sprained ankles were hospitalized. Therapy consisted of 20 to 30 cc. of 1-percent procaine into the hematoma.

Fifteen of the 29 cases showed changes of complete rupture of the lateral ligaments. In these complete ligamentous ruptures the ankle was massaged to reduce the amount of swelling and a nonpadded cast with a walking iron stirrup applied with the ankle at right angles and the foot in midposition. The patient was advised to walk immediately. The cast was worn for 6 weeks. The ankle was strapped with adhesive plaster or put in an Unna's paste boot for 2 weeks following the removal of the cast. At the end of this time recovery was expected. Some patients went to duty with the walking cast. All patients but one have had a satisfactory result—a painless stable ankle without limitation of motion. One case of chronic or recurrent sprain occurred. The cast had been removed after the 2d week because of a skin complication. The ankle was painful and unstable 5 months after injury.

During the same period 12 cases of chronic or recurrent sprained ankles which showed unhealed ruptured ligaments on manipulation and x-ray were admitted to the hospital. One patient was from the present series while 4 had plastic operations and 9 were returned to duty with partial disability. Two of these were treated with braces and 7 with special exercises and high shoes.

In sprained ankles without the total ligamentous rupture, treatment should center around early mobilization with as rapid reduction of the hematoma as possible. An early compression bandage to limit hemorrhage is advisable. Procaine infiltration with massage to disperse the hematoma promotes early mobility.

If the patient's gait is affected, the use of a walking cast with plenty of exercise for 8 to 10 days will hasten recovery. A cast on which the patient does not walk will do harm.

Discriminating physiotherapy is advised. The application of heat alone, such as infra-red, whirlpool, hot compresses, or diathermy is not recommended. Heat alone relaxes the capillaries and causes swelling to persist. Contrast baths, hot one-half minute and cold one-half minute, massage and traction are useful. The traction should be intermittent and gentle and in the long axis of the leg. As much as

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pounds can be used. The traction should start easily and re-
out 3 seconds to reach the maximum and last for about 5 seconds
t is gently relaxed. Such treatment should last about 20
. This may be done manually but is better accomplished by
added ankle halter affixed to a belt around the operator, who
raction by leaning his body weight away from the table on
ie patient is lying.
ionally reconstructive surgery is required in old chronic cases.

SUMMARY

e pathologic changes in sprained ankles are of two types:
nplete ligamentous rupture; (b) hematoma with slight liga-
damage.
e differential diagnosis can be made only by very careful
examination, or by anteroposterior x-ray during manipulation
nesthesia.
e best treatment for complete ligamentous rupture is the ap-
n of a walking cast for at least 6 weeks. Reconstructive sur-
y be required in chronic cases.
e essential treatment for the simple sprained ankle without
igamentous injury is: (a) Early pressure bandage; (b) limita-
he hematoma and swelling by procaine injection with massage
y use; (c) contrast baths or intermittent traction and massage
istent swelling and stiffness.

⚓ ⚓

MODIFIED CANULA FOR ABDOMINAL PARACENTESIS

In the U. S. Naval Medical Bulletin, March 1944, p. 534, Lieuten-
t Levit suggested inserting a catheter through the canula in doing
abdominal paracentesis to overcome the tendency of the gut to
struct the canula orifice. I would like to make another suggestion
accomplish the same end purpose.

While interning at this hospital I assisted a surgeon in draining
abdomen distended with fluid. There was an original spurt of
id and a sudden stoppage. The soft gut was no doubt forced into
d around the canula. It was withdrawn slightly and thrust in
a different angle, with similar results. This was continued
r some minutes, becoming a painful ordeal for the patient and
is given up for the time being. I then bored several small holes
the canula about 1/16th inch in diameter around the distal 1½
hes.

A few days later the canula was inserted again and there was free
d continuous flow of ascitic fluid until the abdomen was drained.—
O'Gregor, E. B., Lieutenant (MC) U. S. N., Retired.

ARTHROTOMY OF THE KNEE

A REVIEW OF 50 CASES

EARL M. ANDERSON
Lieutenant (MC) U. S. N. R.

Arthrotomy of the knee was the most frequent major orthopedic procedure at a Naval base hospital, 50 being performed during a 9-month period. In comparison there were 68 appendectomies in the same period.

The patients were healthy, young, active servicemen, many of whom, however, had histories of knee injuries or symptoms that existed before entry into military service. In civilian life, with sedentary occupations, pain and disability in a knee may be tolerated, but in military service proper performance of combat duty necessitates active treatment.

Pain, an almost universal complaint, was present in 48 of the 50 cases. Swelling in 37, instability in 27, and locking in 24 instances were the other frequent complaints.

Forty-four of the operations were done under general anesthesia, using a patella-splitting incision. A paramedian patellar incision under general or spinal anesthesia was used in the remainder. A survey of the 50 cases revealed that the most frequently found lesion was a torn, displaced, or abnormally mobile medial meniscus, present in 35 patients, in 7 of whom it was the only abnormal condition seen. The lateral meniscus was torn, displaced, or abnormally mobile in 10; in one it was the only pathologic change. One or several joint mice were present in 15 of the 50 cases, always however in conjunction with other changes. Osteochondroma of multiple type was found in one patient.

Synovial membrane changes, including prominence of the vessels, thickening, exudate and adhesions were noted in 18. The infrapatellar fat pad was hypertrophied in 12 instances. Tags of the fat pad which were fibrotic and projected into the joint where they were pinched, occurred frequently in this group. The anterior cruciate ligament was frayed, torn, or lax in 7 of the cases.

The frequency of changes in the articular cartilages of the knee joint was surprising. Chondritis, evidenced by either discoloration, erosion, softening, fissuring, or areas devoid of cartilage was found in 24 instances.

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The majority of the patients with chondritis had a history of symptoms for several months or years, but 6 had symptoms of less than 6 weeks' duration. Chondritis was present on the medial condyle of the femur in 10 cases and on the lateral condyle in 10 others. In 10 others similar changes were present on the posterior surface of the patella. Medial meniscus changes were present in all cases of chondritis of the medial condyle. With the chondritis on the lateral condyle, however, two were associated with joint mice, three with medial meniscus changes, while the remainder had lateral meniscus pathosis. Joint mice, meniscus changes or a hypertrophied infrapatellar fat pad were found with the chondritis of the patella. In all but three instances chondritis of one of the articular surfaces was present in those cases having joint mice.

The incidence of 48 percent of chondritis in operated knees occasions several speculations. Is the chondritis of the articular cartilages a direct result of irritation from an abnormal meniscus or joint mice? An affirmative answer seems justified by the fact that all the cases of chondritis of the medial femoral condyle had medial meniscus changes at the time of operation or had had previous surgery for removal of the meniscus. How much impairment of function does the chondritis itself cause? Is the chondritis permanent, or does it disappear after the removal of the irritating factors? Assuming impaired function and permanent changes, should earlier surgery be done in deranged knees in an attempt to prevent the development of the chondritis? These questions cannot be answered in this survey, nor was literature available to aid in the answer. However, some of the patients with chondritis had reasonably good function while still in this hospital.

Roentgen examination of the affected joints revealed bone or joint pathologic changes in 11 cases, this including 2 cases in which the only x-ray finding was riding of the patella associated with excess fluid in the joint. In only 5 of the 14 cases with joint mice were the joint mice visible by x-ray. Changes interpreted as indicative of osteochondritis were present in but 2 instances.

The 6 cases that had previous knee surgery formed an interesting group. All of the previous arthrotomies had been through a small medial "capsulotomy" incision. Symptoms had persisted or recurred and reoperation here revealed pathologic changes in each of the cases. Variable portions of the medial meniscus were still present in 3 instances, while chondritis was present in 5. These findings indicate that the small medial incision provides an exposure that is inadequate to reveal the pathologic conditions of the knee, and even at times to remove the medial meniscus. It may be argued that further changes occurred after the original surgery, but the generalized findings in the knees first operated here with the wide exposure seemed to show that

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the condition was previously present but not demonstrated. The occurrence of 9 displaced or loose lateral menisci which were not diagnosed previous to operation also shows the value of an incision which permits the removal of the lateral meniscus if it is involved.

Adequate follow-up of the cases has not been possible; therefore little can be written about results or the value of any particular surgical procedure. The patients with good immediate results were returned to duty in an average of 4 weeks and moved with their organizations; those patients with advanced pathologic conditions, complications, or concomitant diseases that indicated a relatively long convalescence were transferred to the United States.

Case report.—A hospital apprentice, aged 24, warrants particular mention, for as a member of the hospital staff he could be followed. He had had pain and locking of his left knee for 4 years previous to his admission. A split-patella arthrotomy revealed a torn lateral meniscus with erosion of the lateral femoral condyle. The medial meniscus was abnormally mobile and there was an increase of synovial fluid with a moderate synovitis. Both medial and lateral menisci were removed at operation. His postoperative course was uncomplicated; he walked on the 13th postoperative day and was discharged to duty on the 22nd. He has since carried on active duty as a hospital corpsman with no symptoms referable to his knee except for occasional aching. Examination 6 months postoperatively showed the wound to be well healed; no fluid was demonstrable, although there was some infrapatellar thickening. Motion and strength were good. Roentgenograms showed a distinct line of division of the patella with no fusion or callus.

SUMMARY

Fifty cases of arthrotomy of the knee are reviewed.

Pathologic changes in knees, as observed with wide exposure, are more generalized than is usually believed. Chondritis of the articular cartilages was present in 48 percent of the patients operated upon.

The review indicated that a small "capsulotomy" incision is inadequate either to reveal or repair the pathologic conditions of a knee joint.

The history of a patient who had surgical removal of both menisci and a good functional result 6 months postoperatively is given.

Conclusions as to the results of surgery are not justified because of inadequate follow-up cases.

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MYOTOMY IN THE REPAIR OF DIVIDED FLEXOR TENDONS

LESTER BLUM
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Wartime injuries of the flexor tendons of the hand may be classified into two main types. The more common is that complicated by simultaneous injury to bone, nerve and intrinsic musculature, frequently with loss of substance, such as in gunshot and shell fragment wounds. The second type is that so often seen in civilian practice in which one or more tendons have been divided by a cutting instrument, such as a knife or bayonet. This communication concerns itself solely with the latter variety.

Before presenting the rationale and technic of myotomy, it would seem relevant to consider the effect of war conditions upon the indications for immediate or for delayed tenorrhaphy. The indications for immediate tendon repair, as formulated by Koch and Mason (*1*), may be summarized as:

1. An elapsed interval of 6 hours or less between the time of injury and that of hospitalization.

2. A reasonably clean hand, and a presumably unsoiled instrument of trauma.

3. A wound, the tissues of which are not grossly contused, contaminated or macerated.

Under conditions aboard ship and in the field it would seem logical to add the following:

4. Availability of the necessary armamentarium and facilities for anesthesia.

5. The patient in sufficiently good condition to undergo the procedure and not in shock or suffering from exhaustion or an acute attack of malaria.

6. An organization whereby the patient can remain in the care of the operator for at least 6 weeks postoperatively.

In the event that any of these conditions cannot be satisfied, experience has shown the advisability of deferring the repair and closing the skin after treatment of the wound. The immediate local use of a sulfonamide may vary these indications. It is wise, however, not to deviate too widely from the empirical plan, because the penetrating nature of hand wounds makes it impossible to place a sulfonamide

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powder in such interstices as tendon sheaths, where infection is most to be feared; moreover, adequate debridement in the hand is an academic concept rather than a feasible procedure. It follows that the irritative particles of caked powder embedded in the tissues cannot be removed and thus cause more harm than good.

Among the factors in tendon repair may be listed the size and location of the wound; the nature of the tissue injury; the amount and specificity of bacterial contaminant; the extent of involvement of neighboring nerves, blood vessels and bone, and the degree of stripping of the tendon sheath. The controllable factors include details of procedure and technic which have been repeatedly emphasized by Bunnell (*2*), Mayer (*3*), and Koch (*1*).

Myotomy is designed to control a hitherto uncontrollable factor: Muscle tension on the divided tendon (*4*). This tension exerts its influence from the moment of injury and throughout the period of convalescence. At the time of trauma, tension causes the characteristic separation of the tendon-ends. There is varying difficulty as the proximal end is found, grasped and brought down into the wound for suture. During the first month of convalescence, this muscle tension tends to disrupt the site of repair by its continuous dehiscent effect. It is only after the first 3 or 4 weeks, when the tendon has sufficiently healed, that this adverse effect becomes beneficial. The tension on the tendon in the sheath then elongates and resolves the adhesions.

Ordinarily the only means taken to minimize muscle tension is the application of a molded plaster splint immediately after tenorrhaphy, with the wrist and fingers in acute flexion. Although this rests the muscle and does decrease its tension, it does not minimize the pull at the suture site. This is demonstrated by the extreme tension found when divided flexor tendon-ends are being brought together with the patient under complete anesthesia. Despite the immobilizing splint, normal muscle tone exerts its continuous dehiscent force on the suture line during the postoperative period. It is this hitherto uncontrollable factor which has made hazardous the immediate institution of active motion after repair.

The rationale of myotomy is the mechanical interruption of the continuity of the tendon with the major portion of the muscle fibers. Only those few muscle fibers remain functioning which are distal to the point of selection for myotomy and are, therefore, still in continuity with the tendon. This condition exists until the myotomy wound has healed and the contractile force of the muscle fibers proximal to the site of myotomy is again transmitted to the tendon.

The flexor muscles of the forearm are of the unipennate and bipennate types with the tendon prolonged throughout the length of

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the muscle. The muscle fasciculi are short. They stem from their bony and fascial origins to insert obliquely into the corresponding tendon prolongation which courses along the volar aspect of the muscle to become the tendon in the carpal tunnel and in the hand. Division of the tendon prolongation results in a loss of contractile power, the degree of which is related to the location of the point of interruption.

The procedure is performed in a few minutes. After the divided tendon-ends in the hand wound are identified, a short linear incision is made just above the wrist. The fascia is divided and with artery forceps the paratenon tissue is gently separated until the corresponding muscle is identified. This is done by gently tugging on the proximal tendon-ends in the hand wound. Forceps are passed under the muscle into the wound as shown in the accompanying illustration. The point of division of the tendon prolongation is selected, about 1 inch of muscle fibers being left to function below it. These are the "functioning muscle fibers" seen in the illustration.

As the tendon prolongation is cut, two observations are made: The marked diminution of the tension which permits the cut tendon-ends in the hand to be approximated, and the displacement of the tendon distally into the hand. The fascia and skin are closed and the operative procedure is completed.

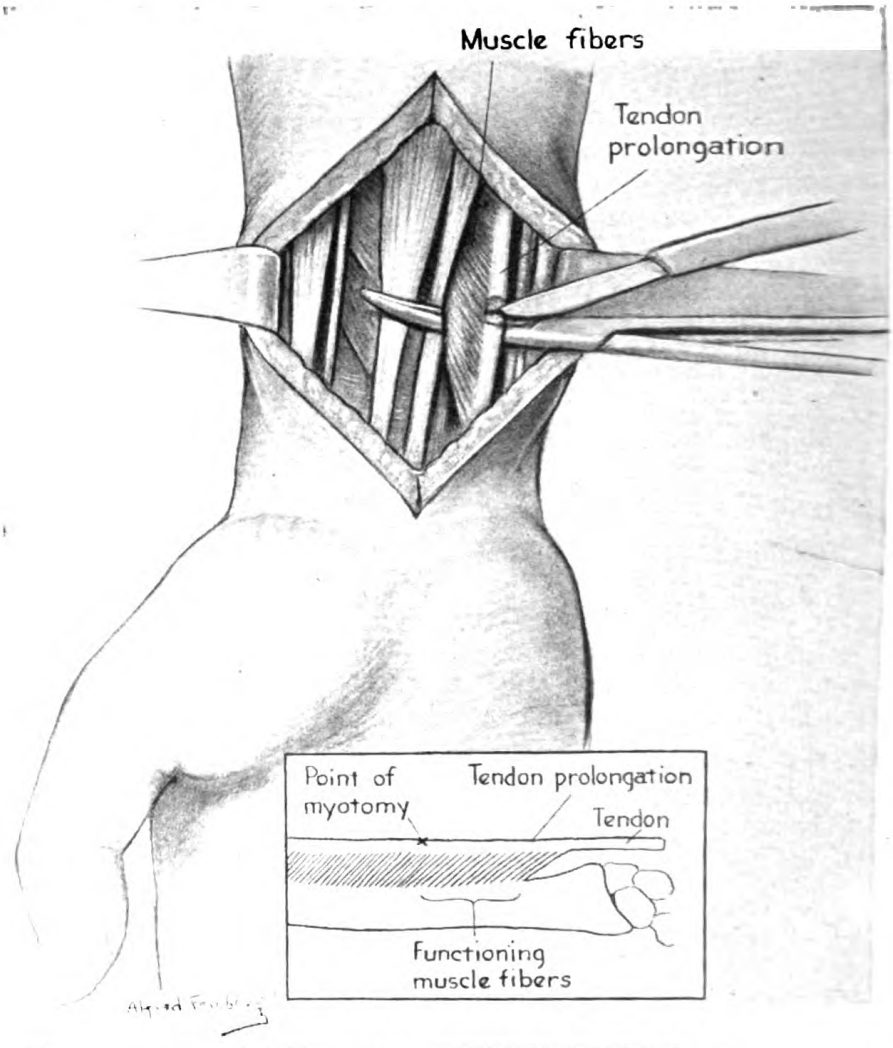
On an empirical basis of a series of unselected cases (*5*), myotomy as an auxiliary to flexor tenorrhaphy was found to possess the following advantages:

1. It is an easily performed, short procedure.
2. It facilitates the handling of the divided tendon-ends by eliminating the tension that ordinarily complicates repair.
3. The danger of disruption of the suture line is obviated. This allows early active motion if desired.
4. Finer suture material can be used in the tenorrhaphy. Arterial silk has been employed.
5. Because of the ease of approximation of the tendon-ends, these can be more thoroughly debrided and trimmed without fear of destroying too much tendon.
6. Because of the absence of tension, the finger can be splinted, postoperatively, in extension with only the wrist flexed. This has two advantages: It is easier to regain function in a finger so maintained than in one that is in acute flexion for 3 or 4 weeks. In the extended finger, moreover, the site of tendon suture is withdrawn into the uninjured tendon sheath away from the point at which the sheath, surrounding tissues, and skin were lacerated. These tendons are almost invariably divided when the fingers are in the grasping or acutely flexed position; thus, the postoperative extension makes it

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less likely that adhesions will form between the tendon suture site and that of the injury to the sheath and skin.

7. In secondary cases with marked retraction or loss of tendon sub-



The method of dividing tendon prolongation by delivering the muscle into wound after dissecting it free from the enveloping paratenon. Note distribution of muscle fibers, particularly as shown in the inset, which is a schematic lateral view at the same level. (*Courtesy, J. B. Lippincott Company.*)

stance, myotomy makes the use of tendon grafts to bridge short intervals unnecessary.

8. There has been uniform return of muscle strength in all cases. As would be expected in so richly vascular a tissue, the myotomy wound evidently heals completely and thus allows full restoration of muscle function.

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CASE REPORTS

Case 1.—A chief carpenter's mate, aged 30, was admitted to a mobile hospital shortly after catching his right hand in a circular saw. The accident caused a division of the flexor pollicis longus tendon in the interphalangeal crease; division of the volar ulnar digital nerve of the thumb; a compound fracture dislocation of the proximal interphalangeal joint of the index finger; a laceration of the dorsum of the middle finger with some splintering of bone, and complete mangling of the distal two-thirds of the ring finger. Inasmuch as the patient's condition was good and the wounds were fairly clean, operation was performed in less than 3 hours from the time of the accident. The ring finger was amputated through the proximal phalanx. The middle finger wound was debrided and sutured. The wound in the index finger was also cleansed and sutured after manipulation had been performed. The divided tendon-ends in the thumb were identified; the myotomy was performed as described and the divided tendon-ends were sutured with the finest silk obtainable. The digital nerve-ends were brought together with one fine suture. There was extensive stripping of the tendon sheath, which could be only partly restored. The skin edges were closed with interrupted silk. A molded plaster splint was then applied with the wrist flexed and the fingers extended. This was not removed until 21 days later when active and passive motion was begun. At the end of the 5th week, some inflammation became evident in the thumb wound and soon took on the nature of a foreign-body reaction. On 20 July a deeply placed silk suture, evidently the major suture, was removed under local anesthesia. Despite this hindrance, the tendon healed with strong, increasing flexion of the interphalangeal joint. Physiotherapy was soon resumed and there was slow but progressive improvement in the range and strength of flexion. Because of the attendant injuries to the other fingers, however, the patient was evacuated to the continental United States about 11 weeks after injury.

Case 2.—A Marine private, aged 19, was admitted to the hospital because of injury to the palm of his left hand sustained while opening a cocoanut the day before. There was a short transverse knife wound in the distal palmar crease with one skin suture in place. There was loss of flexion of the interphalangeal joints of the little finger. Sensation was normal. The hand was splinted and observed for 5 days. Operation was performed, with two palmar incisions located in the flexion creases so as to prevent linear scar formation. The divided flexor digiti quinti profundus and sublimis tendon-ends were identified; there was comparatively little trauma to the ulnar bursa. A typical myotomy was performed above the wrist on the corresponding profundus muscle.

This case was unusual in that the middle third of the forearm had to be selected as the proper myotomy site because of the high insertion of the muscle into the tendon prolongation. The myotomy wound was closed and the usual tendon repair performed in the hand by the Connell technic. The sublimis tendon was not sutured, a small portion having been cut away so as not to impinge on the profundus tenorrhaphy site. It was possible to effect a fairly good closure of the ulnar bursa. The skin wounds were closed with interrupted silk and a molded posterior plaster splint was applied, extending from the upper forearm to the fingertips with the wrist flexed and the fingers extended. The splint was maintained for 3 weeks, the wounds healing by primary intention. Active and passive motion was begun; the return of function was unusually rapid because of the cooperation of the patient who was discharged to active duty 10 weeks after the injury.

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The patient was able to return for follow-up examination 15 weeks after the injury. At this time he was able to flex the interphalangeal joints normally, although he was not able to coil the finger in the palm. The return of muscle strength as evidenced by the tension of the contraction was estimated as at least two-thirds normal.

SUMMARY

The basic principles of tendon repair of the hand apply to war injuries as well as to civilian injuries.

The adverse effects of muscle tension acting upon the site of tendon repair can be obviated by simultaneous division of the corresponding tendon prolongation in the distal forearm.

The procedure of myotomy is easily and quickly performed and expedites repair of the divided tendon.

The myotomy wound heals spontaneously and completely without resultant impairment of muscle strength.

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SULFONAMIDES AND PHAGOCYTOSIS

The effect of six widely used sulfonamide compounds on phagocytosis by human leucocytes was determined.

The sulfonamide compounds tested were divided into two groups on the basis of their effect on phagocytosis by human leucocytes in the dilutions tested.

Sulfanilamide, sulfathiazole and sulfadiazine cause a slight decrease in the total number of human leucocytes showing no phagocytosis and a variable increase in the number of human leucocytes showing moderate and marked phagocytosis.

Sulfapyridine, sulfaguanidine and succinylsulfathiazole cause a slight increase in the total number of human leucocytes showing no phagocytosis and a negligible decrease in the number of human leucocytes showing moderate and marked phagocytosis.—GERSHENFELD, L., and SILVER, M. J.: Sulfonamides and phagocytosis. Am. J. Pharm. 116: 4–13, January 1944.

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RECONSTRUCTION OF THE EXTERNAL EAR

CONSERVATION OF AVULSED PORTION

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The technical problem of total reconstruction of the external ear always has been and still is one of the major problems in the field of plastic surgery. This fact continues to be of great importance because of the necessity of replacement of the auricular cartilage. Without the cartilage as a basic architectural form around which to build skin grafts, little can be accomplished in producing an ear that is satisfactory to either the patient or surgeon.

Certain procedures (*1*) (*2*) (*3*) (*4*) have been developed during recent years that have given promise. The use of rib cartilage, as advocated by Pierce and others, has fallen short of the most desirable result because one cannot obtain a segment of costal cartilage large enough from which to carve out a structure to simulate the normal ear. The procedure developed by Gillies, using a fresh auricular cartilage from a donor ear, or the use of a cadaver ear cartilage as described by Kirkham, provide the best solutions for this problem.

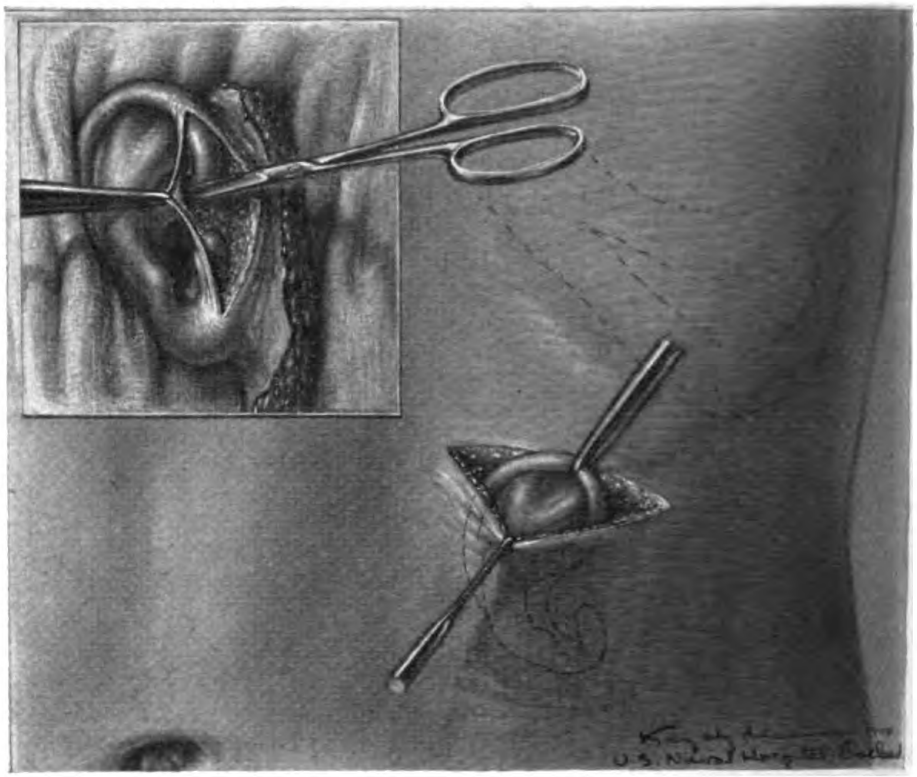
Unfortunately, however, the majority of auricular cartilage isografts, either fresh or preserved, sooner or later undergo a process of aseptic necrosis. On the other hand, evidence has been produced to prove that when autogenous auricular cartilage has been transplanted, it remains viable and does not undergo this process of absorption. In the light of present knowledge the use of any foreign material is still unsatisfactory because of the reactions that sooner or later develop.

In military activities a man frequently has his external ear torn off completely. With a complete detachment, it would be futile to attempt to suture back the avulsed part, even though partial detachments survive when replaced. These survive only because of the fact that an adequate blood supply remains intact. However when confronted with a patient who has had either all or a part of his external ear completely avulsed, the medical officer should at once institute an immediate search for this missing part. While the lost structure as a whole cannot be replaced, the cartilage should be salvaged for future use.

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The detached ear must first be washed gently with mild white soap and sterile water, following which it is irrigated with copious quantities of sterile physiologic saline solution. Using sterile operating technic the cartilage is next dissected free of its overlying skin, care being observed not to fracture the cartilage during the process. Once this architectural support has been obtained, it is placed temporarily in a basin of warm sterile physiologic saline solution.



Upper left shows the cartilage being dissected from its overlying skin, the ear being entirely avulsed. Below is seen the pocketing of the cartilage in anterior abdominal wall.

Unless the operator is familiar with the subsequent steps involved in ear reconstruction (*4*) it is advised that a subcutaneous pocket next be prepared in the anterior abdominal wall. After perfecting hemostasis, the cartilage is placed into the prepared pocket and the wound closed by suture. A pressure dressing is made over the transplanted cartilage so as to minimize hematoma formation.

The cartilage will now remain viable in its new location for an indefinite period. Evidence points to the fact that since it is autogenous the structure will probably not undergo absorption as happens with isografts. An exact framework is now ready for the plastic surgeon for use whenever the opportunity arrives for the actual construction of a new ear.

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EFFECTS OF BED REST

After a person has been in bed for several days, he begins to show loss of muscle tone. As weight is lost the arms and legs become flabby and weak. The venous circulation in the lower extremities is greatly impaired by bed rest and predisposes to the development of phlebitis. This is a very likely occurrence when varicosities are present or when pelvic disorders prevent a normal return flow of blood. The elderly individual who is put to bed is very apt to develop pulmonary stasis. When up and about, he moves rapidly enough and breathes deeply enough to keep the alveolar spaces fairly well filled. When in bed the need for deep breathing is less and, as a consequence, he fills only half of his lung tissue. Atelectasis soon develops and the growth of the ever present organisms is encouraged with resultant pneumonitis. This is also apt to occur postoperatively when the abdominal movements are restricted. Many of these difficulties may be satisfactorily prevented if some of the simple procedures of physiotherapy are practiced. Regular daily passive motion and massage of all the muscles and joints of the arms and legs is always helpful. Active exercise may be permitted in some cases when this exertion will not prove harmful to the patient. Much of the atrophy and uselessness of the muscles in rheumatoid arthritis can be prevented in this way. The motion of the legs and the practice of deep breathing should be encouraged as a preventive against phlebitis and pulmonary embolism. When the patient is

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MARSUPIALIZATION OF PILONIDAL CYSTS

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The occurrence of pilonidal disease in the personnel of the Navy is of such frequency that its surgical correction is a problem of importance. Although the mortality associated with the surgical treatment of this condition is negligible, the attendant period of postoperative disability is considerable.

It is generally agreed that in the presence of acute inflammation of a cyst the treatment should be limited to incision and drainage, and that only after an interval of 7 to 10 days should excision be attempted. The operative procedures commonly employed entail total excision of the cyst. Much disagreement exists, however, over the wisdom of closing the resulting defect. Although excision with primary closure is the ideal operation, in too many instances there is failure to eliminate all dead space with subsequent prolonged drainage.

The alternative method of open packing of the wound after total excision of the cyst minimizes the danger of recurrence but has the serious disadvantage of a prolonged healing period. In the cases reviewed by Lane[1] the average number of sick days after excision and packing was 46, and as a result of a 30-percent incidence of complications, the average number of sick days after primary closure was 47.

For the past 3 years Buie's operation[2] has been routinely employed here. This consists of partial excision of the cyst and marsupialization. The rationale of this procedure is based on the fact that a pilonidal cyst has an epithelial lining which on exteriorization assumes the characteristics of skin.

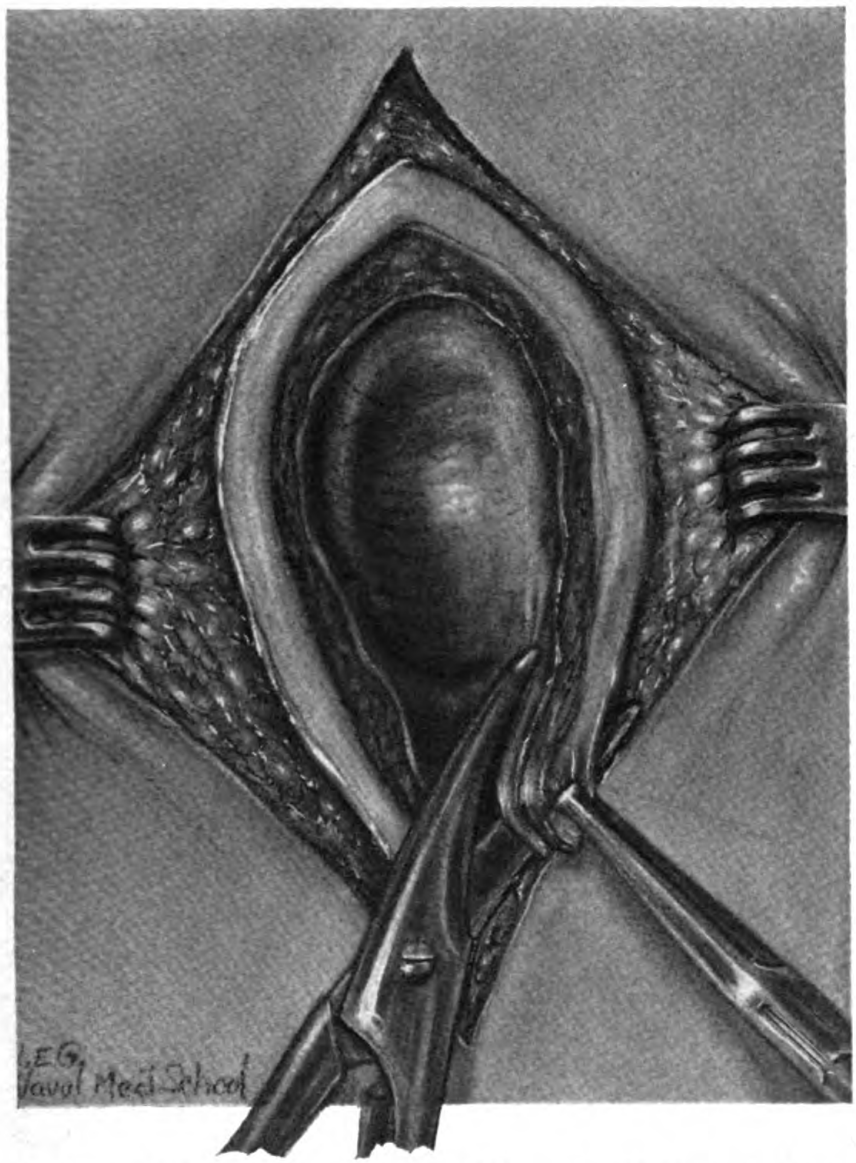
Technic.—Under low spinal anesthesia, the cyst is opened by cutting down on a probe introduced through the stoma of the sinus or through the site of a recent incision. After determining the extent and ramifications of the cyst, a second incision is made which includes

[1] LANE, W. Z.: Pilonidal cysts and sinuses in Navy. U. S. Nav. M. Bull. 41: 1284–1295. September 1943.

[2] BUIE, L. A.: Practical Proctology. W. B. Saunders Co., Philadelphia, 1937. pp. 480–482.

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ithin it an elliptical strip of skin ¼-inch wide. This is excised ogether with the superficial part of the cyst wall (fig. 1). The base f the cyst which remains in the depth of the wound is then attached o the adjacent skin with a continuous locking suture of plain catgut fig. 2). The operative area is covered with a dressing of gauze



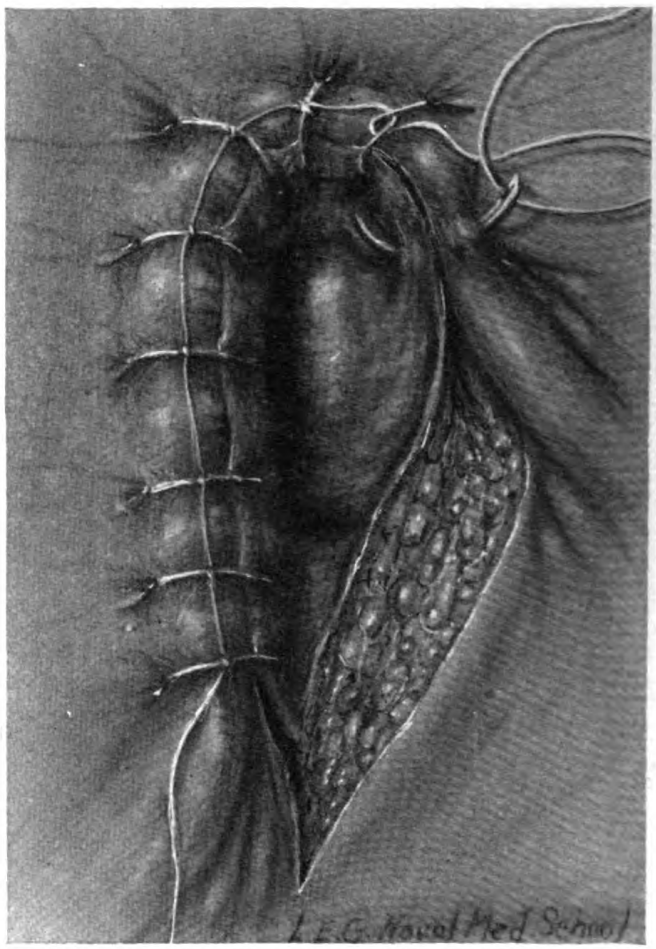
1. Excision of the superficial portion of the cyst and adjacent skin edge.

impregnated with a 5-percent sulfanilamide ointment during the first postoperative week.

Results.—In the average case there is very little reaction about the operative area. Firm union along the line of suture is established in about 2 weeks, and during this period a remarkable transition

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occurs in the cyst remnant. The secretory function of its epithelial lining gradually lessens, and after about 3 weeks it appears as a dry shiny surface (fig. 3). Daily exposure to an infra-red lamp probably stimulates this change. The persistence of a moist spot on an otherwise dry membrane indicates the presence of an accessory tract or pocket which may be promptly effaced by spreading it apart with a



2. Attachment of the remnant of the cyst to the adjoining skin.

mosquito hemostat. After 6 weeks the operative site is marked by a purplish line, with no appreciable depression of the marsupialized remnant.

In more than 50 such procedures no recurrence has been observed. During the past 9 months in service on a large battleship, partial excision with marsupialization has been employed in 6 cases with an average of 21 days lost from duty.

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In the surgical correction of pilonidal disease, the operation of choice is one that effects a cure in a minimal period of time with a



3. Marsupialized cyst 3 weeks after operation.

minimal rate of recurrence. In fulfilling these requirements partial excision and marsupialization of the cyst has distinct advantages over the more conventional operative procedures.

DICOUMARIN THERAPY

Dicoumarin may be administered by mouth or intravenously. Various plans have been found effective. The following dosage plan was found useful:

Dosage: 300 mg. on first day; 200 mg. on second day; 200 mg. on each following day on which prothrombin time is less than thirty-five seconds. Check prothrombin time every twenty-four hours. Response to first dose may be expected in twenty-four to forty-eight hours. After discontinuing dicoumarin, the prothrombin time may be prolonged from two days to two or three weeks, depending on the dosage. Its effect should be maintained for at least four weeks.—DAVISON, F. A.: Synopsis of Materia Medica, Toxicology, and Pharmacology. 3d edition. The C. V. Mosby Co., St. Louis, Mo., 1944. p. 663.

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PILONIDAL CYST

REMOVAL BY TRANSVERSE INCISION
PRELIMINARY REPORT

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and
SAMUEL J. GORHAM
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Many procedures have been used in the surgical treatment of pilonidal cysts. The very fact that there are so many methods would indicate that none of them is wholly satisfactory.

A method of excising a pilonidal cyst was devised which has proved very satisfactory from the viewpoint both of rapid healing and of reducing the period of incapacity. The series of cases in which this method was used is small so far and the postoperative period of observation relatively short; nevertheless it is felt that a preliminary report on this method is indicated because of the good results obtained.

The methods most commonly used are well known. Usually an elliptical longitudinal incision is made circumscribing the cyst and its sinuses. The cyst is removed in toto, including the skin and subcutaneous tissue of the coccygeal region. The incision is closed by one of several methods: (1) Packing the wound and allowing it to heal by granulation tissue from below upward; (2) attempting to close the wound by primary closure; (3) partial closure and drainage by packing with gauze; (4) primary closure plus the instillation of sulfathiazole powder; (5) closure by suturing the edges of the skin incision to the sacrococcygeal fascia (*1*); and (6) the use of irradiation as an adjunct to the surgical treatment for the destruction of hair root follicles (*2*).

Several writers have mentioned the importance of obliterating the dead space to aid in the healing, especially where primary closure is attempted. The minimum time spent in the hospital by any procedure so far reported is 12 to 15 days, and the cure in 6 to 8 weeks. DePrizio (*3*) reported 14 cases in which the patients were ambulatory in from 3 to 4 days and fully healed in 1 month. He uses a vertical incision, undermines the skin and removes the cyst and its pockets. The wound is closed by suturing the edges to the sacrococcygeal fascia.

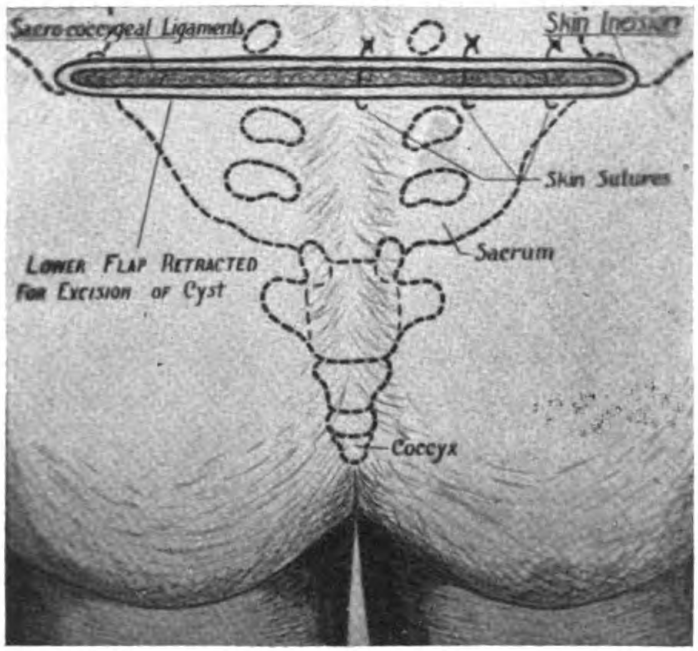
There is general agreement that when the pilonidal cyst is infected and abscessed, it should be treated conservatively by incision and drain-

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age and wet dressings. The differences in opinion lie in the methods of removal of the cyst, once the infection has subsided and the area is completely quiescent.

The principles involved in the procedure advocated here are:

1. The incision is made transversely above the infected area in relatively healthy tissue.
2. The skin and the subcutaneous pad of fat above the coccyx are retained.
3. The cyst together with its sinus is completely removed by dissection from above downward.
4. The resultant dead space is eradicated by numerous sutures through the skin and to the coccygeal fascia.



1. Posterior view showing line of incision and retention sutures in closing wound.

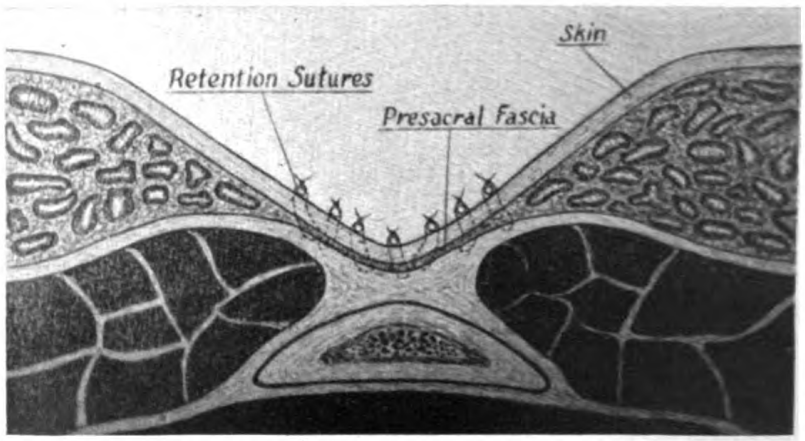
Preoperatively the treatment of the area is essentially the same as that employed in other methods and is aimed at removing any possible residual infection. The entire area of the sacrum and coccyx is shaved, and scrubbed with tincture of merthiolate. One-quarter grain of morphine sulfate and 1/150 grain of atropine sulfate are given hypodermically 15 minutes before operation. Spinal anesthesia, using 100 mg. of procaine hydrochloride, was found to be adequate in all cases for the complete removal of the cyst and closure of the operative wound.

The technic of making the incision is a departure from the usual methods. Two anatomic points are first located at the lower end of the sacro-iliac synchondroses. A transverse incision about 6 inches in length connecting these two points is then made. It is carried through the skin, subcutaneous tissue, and fat to the presacral fascia. The skin

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is clasped with a forceps and brought forward as far as possible. The underlying fatty tissue and the pilonidal cyst with its prolongations and sinuses are then isolated and dissected free with a curved scalpel from the undersurface of the skin. The presacral fascia and the sacrococcygeal ligaments are then cleaned and brought into full view. Any lateral sinus tracts are thus more readily observed and removed. At no time has it been necessary to inject methylene blue (*4*) to delineate the cyst and its projections.

The next step is closure of the dead space. This procedure is of primary importance and is responsible for the short period of postoperative incapacity in these cases. For practical purposes the skin can be considered as a large graft which is sutured directly to the presacral fascia after the removal of the pathologic tissue. By means of mattress sutures of No. 2 dermal, the skin is approximated to the sacro-



2. Cross section showing sutures in situ following cyst removal.

coccygeal fascia from the lowest part of the flap upward to the transverse incision. From the point of entry of the needle to the point of exit from the skin is ⅜ inch. The suture is tied over a pledget of gauze or through a rubber peg. The average number of sutures used is between 20 and 30, depending upon the size of the individual and the size and extent of the pilonidal cyst.

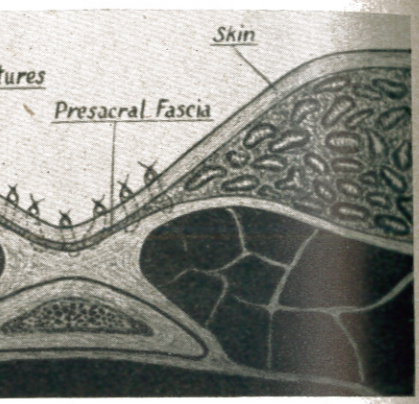
Before starting the closure, 2 gm. of powdered sulfathiazole are sprayed into every part of the cavity by means of a powder blower; thus caking is avoided in the bottom of the wound. The sutures are placed ¾ inch to 1 inch apart in all directions until the entire area of the flap is firmly in apposition to the underlying fascia.

The transverse incision is then closed with interrupted black silk sutures, using the Stewart stitch. If any of the cyst ramifications go above the line of incision, it is necessary to extirpate the fatty tissue in this area and close the dead space with mattress sutures as before. Each one of the mattress sutures used in closing the dead space creates

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a small through-and-through sinus which will help to evacuate and drain any localized accumulation of serum or pus. This occurred in only one case in this series, and the removal of several sutures was all that was necessary to provide proper drainage. The remainder of the skin flap held firmly and healed promptly so that the patient was able to return to duty in 12 days.

This method of removal of the pilonidal cyst has several advantages over other methods. (1) The skin of the sacrococcygeal region is retained in its original position. (2) The obliteration of the dead space promotes rapid healing. (3) The retained skin acts as a strong protection against further trauma.

After 48 hours the wound is inspected by separating the gauze pledgets. Any discharge from the closed space drains off through the sutures and is absorbed by the gauze. After 4 days the area is dressed again. At this time if infection has occurred the sutures in this area are removed, and the small punctate openings through the skin act as a draining sinus. On the 6th day all sutures are removed and a dry dressing is applied.

This operation has been employed in 7 cases and in 6 of them the patient was able to return to active duty on the 10th day. In the one patient in whom a small infection was encountered, convalescence and healing were prolonged to the 16th day.

Follow-up care has been difficult because of the rapid turnover of the men at this base. However an attempt has been made to keep in touch with all patients by mail, and up to now no recurrences of the cyst or breakdown of the operative area has been reported. We realize that the number of cases has been too few and the follow-up period too short fully to evaluate the results of this procedure, but we have been impressed with the rapidity of healing and the postoperative comfort enjoyed by these patients.

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ACUTE APPENDICITIS AFLOAT

A CLINICAL STUDY

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Lieutenant Commander (MC) U. S. N. R.

Analyzing the period of World War I, Boone and Lyons [1] note a marked increase in mortality from appendicitis among Naval personnel. Since this period of 1917-20, the record of the Navy has been indeed admirable in the treatment of this surgical condition.

Now again, Naval personnel have gone to sea in large and increasing numbers, often not coming near a Naval hospital or dispensary equipped for abdominal surgery for long periods of time. It has therefore become a major responsibility of medical officers afloat, particularly on transports with several thousand troops aboard, to have well defined principles as to the handling of acute appendicitis at sea.

As a result of a year's experience aboard a Navy transport, the author has concluded, first, that several additional factors on the incidence and diagnosis of acute appendicitis afloat warrant emphasis; second, that except under most unusual circumstances, the treatment of acute appendicitis must be exclusively surgical if a low mortality is to be obtained; and third, an elicited history of possible appendicitis is a reason for careful surveillance before a man is assigned to sea duty without an "interval" appendectomy.

On this ship, 13 patients with acute appendicitis have been operated upon during the past 10 months without mortality or complications, one of these having a perforation. Other cases have been diagnosed acute appendicitis, but, having been in the immediate vicinity of shore facilities, were transferred. Members of the ship's own complement however have been cared for aboard ship, obviating separation from their home for periods of from 6 to 10 weeks, or reassignment to some other vessel or activity.

Incidence.—Dietary habits, particularly of troops embarking from outposts where they have long been deprived of ice cream, candy and nuts, are to say the least eccentric. The frequent lack of bulk-producing foods aboard ship, along with a sedentary existence in crowded quarters and with head facilities often remote, all tend to interfere with complete and natural defecation.

[1] BOONE, H. R., and LYONS, S. C.: Mortality in acute appendicitis. U. S. Nav. M. Bull. 41: 1273–1283, September 1943.

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The element of nervous tension among outgoing troops on their first sea voyage is likewise conducive to gastro-intestinal disturbance; to this may be added seasickness.

Both acute respiratory and gastro-intestinal infections, the former in cold climates, the latter more often in the tropics, spread among the congested personnel and frequently antedate acute appendicitis. On one occasion the author removed an appendix which, upon culture, yielded a pure growth of pneumococcus. The patient had had a severe catarrhal fever 8 days before.

Clinical picture.—It is not the purpose of this paper to reiterate the various symptoms and signs of appendicitis or the usual differential diagnoses involved, except to reemphasize Christopher's statement that "few abdominal conditions can present so many different clinical pictures." Aboard ship several additional differentiations warrant discussion.

Seasickness is not infrequently associated with abdominal pain and soreness, usually the result of frequent retching and concurrent abdominal muscular strain. The muscular soreness is generally quite superficial, and localized involuntary rigidity is absent. The findings are more marked in the epigastrium and are aggravated by deep breathing. There are the usual symptoms of headache, dizziness, pronounced weakness, subnormal temperature, and, except with marked dehydration, a normal blood count.

It must be kept in mind, even though elemental, that the patient may be seasick and also have appendicitis; and that in rough weather, with several hundred seasick, it is easy for both the patient and the medical personnel to be misled. It was in such an instance that a perforated appendix occurred—the corpsman seeing "just another seasick patient," and the latter lying in his quarters quite satisfied that his only relief would come with debarkation. Fortunately operation and sulfonamide therapy were followed by recovery.

In this regard it is important that each new assignment of troops be told, via the address system, *where* the sickbay is and *how* to get there in case of illness. A ship to a newcomer is confusing, and distances appear insurmountable, particularly in rough weather. It is also important that the medical officer, during the daily ship's inspection, request each hold officer to make note of men ill and to see that these receive appropriate medical attention.

Heat exhaustion.—In tropical climates men who are subject to the excessive heat of the fireroom, galley, laundry, etc., are frequently seized with abdominal cramps and nausea simulating appendicitis. Replacement of salt and fluids, if necessary by intravenous route, quickly differentiates this from appendicitis.

At times, salt tablets taken with inadequate water have also brought on abdominal pain requiring similar differentiation.

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Iliac lymphadenitis.—Because of the high incidence of trichophytosis with secondary pyogenic infection of the feet in warm climates, inguinal adenitis and not infrequently iliac adenitis occur. The latter may simulate an acute appendicitis.

Seminal vesiculitis.—Routine rectal examinations of the seminal vesicles should always be made. This complication may give symptoms closely simulating appendicitis, particularly of an appendix in a pelvic location. An acutely tender, boggy prostate should arouse suspicion.

Treatment.—On transports or ships with similar surgical facilities, it is felt that the indications for immediate surgery in acute appendicitis are the same as ashore. On ships not equipped to handle the surgery, or where a ship's immediate mission makes it advisable, the patient should be transferred at the earliest feasible moment. Delay, with or without sulfonamide therapy, may lead to regrettable consequences. The symptoms do not always accurately indicate the character or extent of the infectious process.

Spinal anesthesia (procaine hydrochloride 150 mg.) and a McBurney incision ordinarily provide the least disablement, a factor when the abandoning of ship may be a possibility. The patient should be placed in a bunk easily accessible to an exit.

The corpsmen are benefited by the handling of these surgical cases aboard. An operating-room technician on this ship has in the past year organized and trained 3 operating-room teams with the result that recently in the handling of 250 battle casualties, many directly from the front lines, 2 operating rooms functioned with remarkable efficiency and a minimum of confusion.

CONCLUSIONS

1. Afloat or ashore, the prognosis in acute appendicitis varies directly with promptness of diagnosis and early operative treatment.

2. Several differential diagnostic problems arise with the patient aboard ship; chief of these is the evaluation of seasickness.

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NONSPECIFIC INFECTIVE GRANULOMA OF THE APPENDIX

REVIEW OF LITERATURE WITH CASE REPORT

JOSEPH I. ANTON, M. D.
and
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Lieutenant Commander (MC) U. S. N. R.

The amazing rapidity and completeness with which huge inflammatory exudates and masses may disappear from the abdomen have often been recorded. Nonspecific infective granuloma of the appendix belongs in this category. Mock (*1*) in 1931 recognized the condition as a definite pathologic entity and termed it infective granuloma.

Although the condition is not a tumor in the true meaning of the word, pathologists disagreeing as to the correctness of the term in describing a mass of granulation tissue, to most clinicians and surgeons the suffix "oma" when used in this connection conveys the idea of a tumorlike mass invading some tissue or viscus. The term "inflammatory hyperplasia" on the other hand suggests no more than an overgrowth of granulation tissue.

In a classical study of the subject of nonspecific granulomas of the intestine, Ginzburg and Oppenheimer (*2*) called attention to the remarkable powers of resistance to infection and striking tendency to undergo resolution possessed by the intestine and peritoneum. The regenerative power of the intestinal mucosa is evidenced by its ability at times to heal without any evidence of permanent scarring despite the ravages of extensive injury or disease. In some instances however this regeneration does not take place.

When incomplete healing results, due either to the persistence of low-grade continuing infection which the tissues are unable to overcome or to some other chronic irritation such as trauma, a sequence of coexisting destructive and reparative processes supervenes. Ultimately this gives rise either to hypertrophic, peri-intestinal "tumor" formation, extensive intramural hypertrophic ulcerative or stenosing lesions, or to the combination of both. A mass as large as a cocoanut may result.

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INCIDENCE

Nonspecific infective granulomas probably occur much more frequently than is generally believed and too often are subjected to radical surgery because of a mistaken diagnosis of malignancy. A perusal of the literature shows that such granulomas involving the appendix occur rather infrequently in adults and are extremely rare in children. Only 18 cases have been reported. To this is added another case occurring in an adult.

TABLE 1.—*Reported cases of nonspecific infective granuloma*

Author	Date	Age	Sex	Treatment	Result
Regling	1902	59	M	Tumor, appendix and portion of ileum and cecum removed.	Death.
Gangitano	1909	32	F	Tumor and appendix removed	Recovery.
Goto	1912	52	M	do	Do.
Goto	1912	59	M	do	Do.
Läwen	1914	51	F	Tumor, appendix, portion of ileum and cecum removed. Ileotransverse colostomy.	Do.
Teitze	1917	25	M	Drained	Do.
Korte	1921	38	(?)	Appendectomy	Do
Korte	1921	33	(?)	Tumor, appendix, part of ileum and cecum removed.	Do.
Korte	1921	50	(?)	Tumor, part of ileum and cecum removed. Appendix not isolated. Lateral anastomosis of ileum to cecum.	Do.
McArthur (quoted by Mock).	1931	Adult	M	Appendectomy. Later drainage of infected granuloma.	Do
Mock	1931	22	F	Tumor and involved bowel resected. Ileocolostomy.	Do.
Gunn and Howard	1931	41	M	Tumor and appendix removed	Do.
Eggers	1933	64	M	Tumor not removed. Ileocolostomy. X-ray therapy.	Do.
Gowen and Van Alstyne	1933	22	M	Tumor and appendix removed	Do.
Janssen (quoted by Gordon).	1933	21	F	Appendectomy	Do.
Morris	1933	23	M	Tumor and appendix removed. Colocolostomy above obstruction.	Do.
Ireland	1934	11	F	Appendix and most of mass removed.	Death.
Gorelik	1942	9	M	Appendix and mass removed	Recovery.
Anton and Weintrob	1943	23	M	do	Do.

Shelley (*3*) in a study of 881 patients operated upon for so-called chronic appendicitis at St. Luke's Hospital in New York City mentioned six cases diagnosed microscopically as carcinoid and one as carcinoma. Not one was considered to be a granuloma. Nor is any use of the term to be found in an excellent study by Raiford (*4*) of a series of 986 "atypical" growths of the gastro-intestinal tract among which were described 8 benign and 9 malignant tumors of the appendix. The series included only those cases in which infectious processes presumably failed to play any part.

In a fairly comprehensive monograph on tumors of the appendix Storey (*5*) states that primary malignancy of the appendix is rare. He adds that most tumors encountered in this organ are benign. Listing the varieties as carcinoid, adenocarcinoma, myoma, myxoma, hemangioma, and neuroma, he infers that there may be others. He

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makes no mention of nonspecific infective granuloma of the appendix, but states that "the appendix is also susceptible to specific granulomata such as are caused by syphilis and tuberculosis."

The first reported case involving the intestine was by Gassenbauer in 1898. Nonspecific infective granuloma of the appendix appeared first in the literature when Regling (*6*) described such a case in 1902. Up to 1934 Ireland (*7*) succeeded in collecting only 14 reported cases involving the appendix. Since then Gorelik (*8*) has added a case encountered in a boy 9 years, 6 months old. Our case occurred in a young man of 23 years.

In the series collected by Ireland no case occurred in a young child, the ages ranging from 21 to 59. He added a single case which, however, proved to be a combination of carcinoid and nonspecific infective granuloma in a girl of 11 years. Only one of the previously reported cases terminated fatally. His own patient expired as the result of a generalized peritonitis following an acute exacerbation of a probable previously existing chronic appendicitis. He viewed the sequence of events as follows:

A carcinoid was present in the wall of the appendix. In time, due to increased growth, it produced an obstruction of the lumen with consequent inflammation distal to the point of narrowing. Rupture occurred soon after followed by localization of the infection. Ultimately a granuloma developed that grew into the omentum. An acute exacerbation of the chronic infection of the appendix supervened. Rupture took place and a fatal peritonitis followed.

Gorelik's case presented a suggestive history of appendicitis with a sudden onset. Four days before being seen by a physician, the child complained of intense continuous pain in the "pit" of the abdomen. There was neither nausea nor vomiting and defecation gave only slight relief with severe pain returning shortly thereafter. Finally the pain became localized in the right lower quadrant of the abdomen.

The past history was essentially negative. On examination tenderness was elicited over McBurney's point. At times it was felt that an indefinite mass could be palpated in the right lower abdominal quadrant. The blood count revealed 14,000 leukocytes with a differential of 80 percent polymorphonuclear leukocytes. The rectal temperature was 100° F.

At laparotomy a reddened, inflamed mass was found adherent to the cecum and the appendix. This was dissected from the cecum up to the base of the appendix. The cecum was markedly congested and thickened at the site of adherence to the "tumor" mass. Upon gross examination the mass, about the size of a walnut, was found to consist mainly of fibrous tissue. No lumen was discernible. Microscopically remnants of appendicular tissue were revealed. The remainder of the

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mass was composed of inflammatory connective tissue with areas of polymorphonuclear leukocytes and round-cell exudate about an infected appendix. The diagnosis was granuloma about an infected appendix. The postoperative course of the patient was uneventful.

Usually when the appendix is the source, as it was in Gorelik's case and in ours, it will be found to be part of an inflammatory mass that is "buried" in the cecal wall or in the wall of the terminal ileum. The involvement is mainly pericecal and subserosal. The mucosa of the cecum apparently remains intact. Extension in these parts is by contiguity.

Mock presented a case that well illustrates another characteristic of this type of granuloma, the presence of a foreign body within a granulomatous mass. A 22-year old woman had been operated upon for a mildly acute appendicitis. Two and one-half years later she had recurrence of right lower abdominal pain associated with nausea. The area was tender and a mass the size of an orange was palpated. Upon operation a tumor mass was found involving the distal 2 inches of the ileum and the entire cecum. Grossly and from study of a frozen section of a small fragment of the mass it was decided that the tumor was a carcinoma. Resection of the tumor and involved bowel was performed, followed by a lateral anastomosis of the ileum and ascending colon near the hepatic flexure. The final histopathologic diagnosis was infective granuloma of the cecum.

In Mock's opinion the nucleus and undoubted cause of the infective granuloma was a linen purse-string suture that was present in the head of the cecum and was situated almost at the very center of the tumorlike mass. Teitze (*9*) reported a similar case. If it were possible to be positive of the diagnosis at the time of operation, the surgery performed could be much less radical, with consequent lowering of operative risk and saving of embarrassment in advising the patient or his family of the presence of malignancy.

When a mass is found associated with the large bowel, greater involvement of the mesentery than is usually encountered in carcinoma, unless this is well advanced, is highly diagnostic of nonspecific infective granuloma.

In a survey of the literature a number of interesting "misdiagnoses" were noted. Robson, quoted by Mock, described the case of a man of 55 years who had a tumor in the ascending colon and presented the classical symptoms of malignancy. Several years previously he had had a similar mass that "disappeared" under observation. This history, supplemented by the fact that the tumor appeared to be rather fixed and extensive, caused Robson to decide against any surgical procedure. At the end of 6 months both tumor and symptoms had disappeared spontaneously.

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During the course of a laparotomy for cholecystectomy, Braun (*10*) investigated the condition of the cecum on which some 13 years previously he had made a diagnosis of carcinoma. Much to his surprise there was no longer any mass present. Moynihan (*11*) in 1907 discussed 6 patients upon whom he operated under the mistaken impression that the condition was malignant.

Mock's 5 additional cases, wherein colostomy for supposedly inoperable malignancy of the large bowel or rectum was performed, offered further evidence of the difficulty of grossly distinguishing noninfective granuloma from carcinoma. At the end of from 1 to 3 years in these 5 colostomized cases no sign of a mass remained. A similar disappearance of the mass within a 3-year period was noted in 3 other cases in which short-circuiting entero-enterostomy was done for massive tumors of the large bowel.

PATHOLOGY

Frozen section is unreliable. Even under the best circumstances, granulation tissue is not always easily differentiated from carcinoma, syphilis, or tuberculosis since the former presents fibroblasts, lymphocytes, giant cells, endarteritis, etc. Occasionally it may even be confused with amebic disease, actinomycosis, or bilharziasis.

Histologically throughout the mass of noninfective granuloma varying degrees of both acute and chronic inflammation will be found. This is evidenced by the infiltration of lymphocytes, polymorphonuclear leukocytes, plasma cells, and varying degrees of fibroblastic proliferation as well as degenerative changes, as hyalinization, calcification, and even bone formation. Giant cells are common.

The presence of giant cells is considered an accidental finding and is thought to be due to the nonabsorbable vegetable matter (incorporated within the lesion as the result of deep ulceration) remaining entrapped within the "healing" areas of the tissues. These particles of nonabsorbable vegetable matter act as foreign bodies.

Special staining methods have demonstrated the presence of giant cells in the subserous and serous layers of the bowel. When in the serosa, they appear as small nodules that are distinguished with great difficulty from those of miliary tuberculosis.

Of interest in this connection is the experimentally induced foreign-body tubercle that appears throughout the abdominal cavity following the intraperitoneal introduction of an emulsion containing vegetable matter.

ETIOLOGY

Although in some instances the appendix may be the source of a granuloma, it is not always the originating factor in tumor forma-

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tions of this type located in the right lower quadrant of the abdomen. When it is the source, occurring as the result of an unresolved chronic appendicitis, the so-called appendicitis fibrotica is encountered as a hyperplastic fibrotic mass.

As previously quoted cases have demonstrated, a granuloma may arise "in" and be adherent to the outer wall of the cecum or even be found in proximity to the terminal ileum. Minute abscesses have been found with or without coexistent fistulas leading into the cecum during the process of mobilizing the appendix for removal. These characteristics of a granuloma may be the result of foreign bodies, as for instance fish bones and splinters emerging from the lumen of the bowel. Or they may arise from the bowel wall itself as when infected diverticula are present. A third etiologic factor may be a foreign body lying free in the peritoneal cavity. Instances of such an origin for granuloma have been reported in cases in which a laparotomy sponge or an instrument has caused trauma to the outer wall of the bowel and led to formation of a granuloma.

In cases involving the cecum, the appendix may become part of the gross picture by means of a spread of the infection through contiguity. Thus the appendix may become situated within the confines of such a mass and erroneously appear to be the origin of the granuloma that has developed.

McArthur's case (quoted by Ireland) is significant because of its workmen's compensation aspect. A riveter sought medical attention because of a swelling in the right lower quadrant of the abdomen. This was visible when the patient was lying in the prone position. At laparotomy a mass the size of a cocoanut was found involving the cecum, and to this several loops of bowel were adherent. As it was considered malignant and inoperable a specimen was taken for biopsy and the mass left in situ. The pathologic report was "chronic inflammatory hyperplasia." Three weeks after operation the mass was no longer visible or palpable. Four months later however it reappeared, and at a second operation an inflamed appendix was removed from the center of the recurrent mass. The patient had been accustomed to hold the blunt end of the riveting tool against his abdomen, making strong pressure against the right lower quadrant. It was believed that the long-continued trauma over the appendicular area accounted for the chronicity of the condition.

Trauma may lead to the formation of this type of granuloma if a tear of the mesentery occurs. The latter may result in the escape of intestinal contents through a small perforation of the bowel leading in time to the formation of a granuloma. In Mock's article a number of unquestionable examples of the effect of trauma in the production of nonspecific infective granuloma are described. Foreign bodies

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reported as initiating these tumors include portions of bone, hard fruit cake, and even silk ligatures about the site of a previous gastro-enterostomy.

Granulomas of this traumatic type have been known to appear at the site of a gastric ulcer, and, with the associated enlargement of the regional lymph nodes, present the gross appearance of malignancy. They have followed necrotic degeneration of intestinal polyps and inspissated masses of feces in elderly people whose peristaltic action is delayed with consequent resultant pressure necrosis of the bowel walls and its sequela of low-grade infection. Also they may form at the site of a solitary ulcer of the intestine or an infected mesenteric lymph gland, in an area of necrosis of the bowel wall after infarction of the associated mesentery, and in partial volvulus or intestinal obstruction from adhesion bands bringing about a marked reaction in the adjacent omentum but falling short of producing a complete bowel obstruction and gangrene. Instances of such granuloma formation have been observed in hernial sacs where there was sufficient constriction of the bowel to bring on an inflammatory hyperplasia that causes the entire mass to become matted together in "tumorlike" formation. A few cases have been reported as a result of massive ligation of the omentum, and after the use of metal or silk sutures in the abdominal wall.

SYMPTOMATOLOGY

Although in nonspecific infective granuloma of the intestine a rather uniform pathologic picture is presented, there is really nothing so distinctive of this condition that one may with reasonable certainty venture a preoperative diagnosis. When the right lower quadrant of the abdomen is involved, whether it be the cecum per se, the cecum plus the appendix, or the cecum plus both the appendix and a segment of the terminal ileum, it is questionable prior to operation whether it can be distinguished from malignancy, a so-called chronic appendicitis, or at times, if the patient's temperature is elevated and the leukocyte count increased, an exacerbation of a previously existing chronic appendicitis.

The presence of nausea, a mild abdominal discomfort, or even slight pain, vomiting, and local tenderness characterize the involvement in the right lower abdominal quadrant, but these symptoms are not peculiar to granuloma. Nor is the finding of a slight fever and a mild increase in the white blood cell count of particular significance. When fever is higher, pain more intense, leukocytosis more marked, tenderness greater, and a generalized abdominal pain precedes localization to the right lower quadrant, the more likely is the diagnosis of either an acute appendicitis or Meckel's diverticulitis.

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Naturally with symptoms pointing to obstruction of the bowel, it is not unreasonable to suspect an infected malignancy of the cecum or ascending colon. When at laparotomy a mass is found, this provisional diagnosis will gain more weight. Frequently if both obstruction and inflammation of the bowel are associated in the right lower abdominal quadrant, tuberculosis of the intestine will be suspected.

X-ray examination is not only valueless but a source of potential difficulty. The finding of an obstruction does not differentiate between that due to granuloma and that resulting from a malignant tumor. Quoting from Mock, ". . . on the other hand, escape of the barium into fingerlike projections, pouches or pockets in the mass is very suggestive of granuloma." It is doubtful, however, if much weight should be ascribed to such an x-ray finding. A spreading peritonitis may even be produced as a result of barium carrying some infected material through a thinner portion of the mass and out into the general peritoneal cavity. Further, infection in and about a carcinomatous mass may at times produce the same type of roentgenographic findings.

TREATMENT

Once the abdomen is open, the decision as to the procedure that should be followed in general may be governed by the following rules. These procedures are based upon experience as gathered from a study of reported cases.

1. The mass strongly suggests an inflammatory origin, obstruction is absent, no pus is encountered. Attempt local removal only.
2. The same condition is present but pus is also encountered. Simple drainage usually leads to cure.
3. Obstruction is present but no pus. Sidetracking anastomosis should be done.
4. Obstruction and pus are present. Sidetrack, drain, and insert sulfanilamide.
5. Mass appears to be malignant and is considered inoperable because of size and involvement of other tissues. Do a biopsy.

It may happen that a mass considered to be malignant and inoperable, upon biopsy is reported as a granuloma. Persistence of symptoms of an inflammatory nature gives rise to much concern. In such a situation, or if obstructive signs or symptoms appear, reoperation is indicated. A sidetracking operation will be advisable with or without sulfanilamide as the presence of pus will dictate.

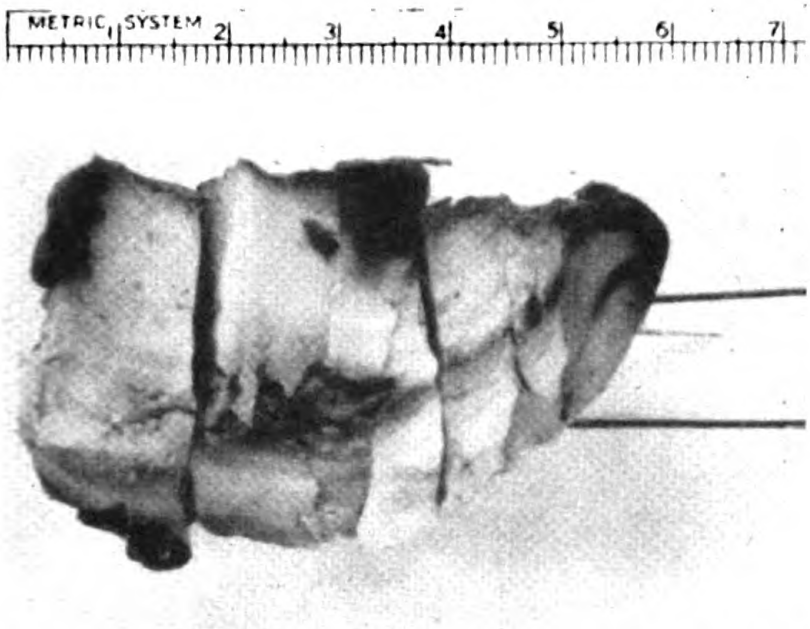
CASE REPORT

A 23-year-old man was admitted to a civilian hospital with the complaint of nausea, pain in the right lower quadrant of the abdomen, anorexia, and loss of weight of 2 weeks' duration. It began with a stabbing pain in the

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right lower quadrant of the abdomen preceded by nausea and vomiting. Walking or standing aggravated the pain. After remaining at home for several days, the patient felt better and returned to work. Although he still had slight pain he followed his usual occupation for a week, when the pain became so severe he had to stop working. He remained at home until the day of admission when he attempted to go to work but experienced a severe exacerbation of the pain. He stated that he had had no previous attacks. His father had had carcinoma of the stomach. The patient's past history was irrelevant.

On abdominal examination, tenderness, spasm, and a palpable mass were found in the right lower quadrant. Tenderness over McBurney's point was exquisite. On rectal examination there was marked tenderness and a mass could be palpated in the region of the right lower quadrant of the abdomen. Blood count revealed 14,450 leukocytes with a differential of 90 percent polymorphonuclear leukocytes. Results of other laboratory examinations were



1. Tumor mass including the appendix, the latter embedded and not showing.

negative. A Frei test several days postoperatively also yielded negative results. The provisional diagnosis was acute appendicitis with abscess formation.

At operation a tumor mass, about 6 cm. by 3 cm. was found in the right iliac fossa. It was adherent to the anterior and posterior parts of the abdominal wall. The terminal portion of the mass, which tapered off, was connected with the wall by a cartilagelike tissue. About 3 inches from the ileocecal junction, a small portion of the wall of the ileum was adherent to the mass. The terminal ileum did not reveal any lesion upon inspection and palpation. The terminal cecum was indurated and seemed to blend with the tumor mass. The greater omentum was adherent to the terminal pole of the tumor mass. The appendix was found to be traversing the long axis of the tumor mass, occupying the midportion of the latter. It was markedly thickened, grayish in appearance, and on section contained a small amount of thin, brown material, probably fecal in nature.

The tumor mass was carefully separated from its attachments to the surrounding structures and exteriorized. An oblique incision was made on each

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side of the mass about ¼ inch distant from the terminal cecum. By blunt dissection on each side the proximal portion of the appendix was identified in the central part of the tumor mass. By retracting the tissues proximally the base of the appendix was exposed and ligated with chromic No. 2 catgut sutures. The appendix together with the tumor mass through which it passed was then removed. To cigarette drains were inserted into the fossa previously occupied by the tumor mass.

The pathologic diagnosis at that time was acute, subacute and chronic appendicitis. The slides in this case were subsequently reexamined and the diagnosis changed to nonspecific granuloma of the appendix. The pathologic report was:



2. The granulomatous process in the wall of the appendix.

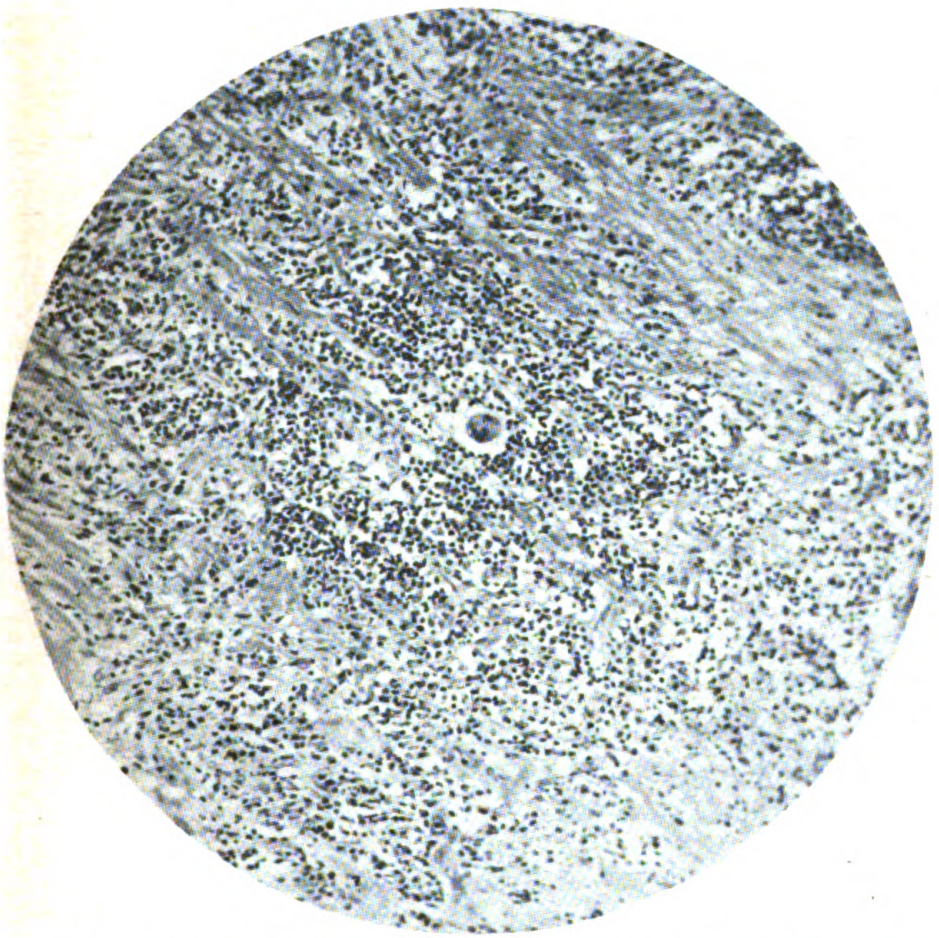
Gross.—The specimen is an enormously enlarged appendix. It is very fibrotic, hemorrhagic in spots, and almost of a cartilaginous consistency. On section the wall is greatly thickened, with the lumen and muscular layer of the appendix seen as a central core running along the entire length of the specimen. The lumen is patent everywhere and contained a very slight amount of thin brownish material, probably fecal in nature. Multiple cross-sections of this specimen produced no pockets or areas of suppuration.

Microscopic.—Lymphoid elements of the mucosa are markedly reduced. Lymphoid follicles are small and few in number. Scattered among the lymphatic cells are numerous plasma cells and many eosinophilic polymorphonuclear leukocytes. Embedded here and there in the interstitial tissue of the mucosa are sev-

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eral multinucleated giant cells. The nuclei of these giant cells are arranged either in a circular manner around the periphery or collected together in one portion of the giant cell. The mucosal lining itself shows no abnormality.

The entire wall of the appendix is thickened, due partly to edema and partly to fibrosis. The latter is marked. The van Gieson stain shows that most of this increase in thickness is due to an exuberant overgrowth of granulation tissue in the subserosa. Lymphocytes, and to a lesser degree plasma cells and eosinophilic polymorphonuclear leukocytes, are found scattered throughout the granulation



3. In the center of the granulomatous area is a multinucleated giant cell.

tissue layer mainly in a perivascular manner. There is extensive hemorrhage along one aspect of this encircling layer of granulation tissue. Numerous capillaries are found everywhere, many being arranged in a parallel manner such as is seen in typical inflammatory granulation tissue. Throughout the mucosa and muscularis there are many large nerve fibers. In one area, separated by a thin strand, two large islands of proliferating neuromatous tissue are observed. Final diagnosis: Nonspecific granuloma of the appendix.

The postoperative course was marked by a temperature of 104.4° F. appearing on the evening of the first postoperative day and becoming normal on the fourteenth day. The lungs were clear. There was no vomiting, abdominal distention, or urinary complications. At the time of discharge (40 days after operation) there still was a moderate amount of brownish, purulent material draining from the wound. The remainder of the wound healed by primary intention. On discharge the patient's appetite and digestive function were good; he looked and felt well.

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Because of persistent drainage from the wound, the patient was again admitted to a hospital 3 months later. At the secondary operation a fistulous tract leading from the skin surface to the cecum was found. The specimen consisted of a piece of skin in which there was an opening from which a somewhat narrow discolored tract led downward to and through a mass of firm gray tissue. Microscopically the tract was surrounded by granulation tissue densely infiltrated by mononuclear cells. It was surrounded by scar tissue. The pathologic diagnosis was abdominal fistula with chronic inflammation. The patient was discharged in good condition 19 days after operation and has remained well.

SUMMARY AND CONCLUSIONS

1. The reported cases of nonspecific infective granuloma of the appendix are brought up to date and another case is added.

2. The appendix is not the only source of this type of granuloma found in the right lower quadrant of the abdomen. The presence of a foreign body within the "tumor" mass is a not uncommon finding.

3. When such a mass is found in the vicinity of the large bowel, greater involvement of the mesentery than is usual with carcinoma should lead to the suspicion of a nonspecific granuloma.

4. Microscopic examination by frozen section is believed unreliable.

5. Such granulomas have been found near peptic ulcers, intestinal ulcers, in the abdominal wall, and attached to infected mesenteric lymph glands and to the area of necrosis in the bowel wall after infarction. Coexistent fistulas leading into the cecum are not uncommon.

6. There is no typical symptom-complex. Hence preoperative diagnosis is difficult.

7. The treatment is discussed. Recognition of the possibility of this condition will avoid misdiagnosis in many instances and obviate the necessity for radical removal.

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ACUTE HEART STRAIN

Acute heart strain occurs in the healthy or diseased heart, either in the male or female, when there is an unexpected sudden severe stress placed upon the heart due to some unanticipated, added physical strain thrown upon a person who is already doing almost capacity work. The symptoms are:

Onset.—To be considered, the symptoms must come on during or immediately after the performance of some strenuous work, when cardiac stress and aortic pressure are at a maximum.

Pain.—This may vary greatly and still be significant. It may be precordial or substernal in location.

Weakness.—This varies from just a disabling weakness to complete unconsciousness.

Dyspnea and palpitation.—These two symptoms occur at the time of onset of the condition and often become permanent, growing worse with time or effort.

Disability.—The cardiac response is definitely limited after an acute strain, with any exertion producing marked cardiac symptomatology.

Heart failure.—If the patient continues to work, the symptoms of heart failure often ensue.

Death from primary heart strain.—This occurs as a rule only when some preëxisting cardiac pathologic lesion is aggravated by the strain.—PARSONNET, A. E., and BERNSTEIN, A. B.: Heart Strain: Critical review; development of physiologic concept. Ann. Int. Med. 16 (O. S., 21): 1123–1136, June 1942.

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LESIONS OF THE MALE BREAST

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It is the purpose of this article to direct attention to certain pathologic disorders that might occur in the male breast.

In civilian practice disorders of the male breast are rarely encountered. Even physicians who are particularly interested in diseases of the breast have only infrequently observed such lesions in the male. That the medical officer serving in the armed forces is likely to see instances of male breast disorders is borne out by the experience of Sullivan and Munslow (*1*) who observed 5 cases of gynecomastia in a group of 20,000 soldiers. Word and Reed (*2*) have reported the findings in 20 cases of breast disorders occurring among the admissions to Camp Shelby Hospital during a period of 17 months.

The views expressed here represent chiefly the consensus in the literature relative to the incidence, symptomatology, diagnosis, pathology and treatment of lesions of the male breast.

The term gynecomastia is unsatisfactory. By some (*3*) it has been defined as an enlargement of the male breast simulating in size and appearance the virgin female breast. Others (*4*) consider it to mean a specific pathologic picture such as fibro-adenomatous hyperplasia. Since the term, loosely used, may include various types of breast hypertrophy or hyperplasia, fatty deposits, inflammatory lesions, and benign or even malignant tumors in their early stages, scientific accuracy would be better served if this meaning were discarded and the word restricted to the specific clinical appearance or a definite pathologic picture.

Diffuse enlargement of the male breast.—This clinical syndrome may be divided into three classes, depending on the type of tissue change involved:

1. Hyperplasia of breast tissue elements.
2. Local fatty tissue deposition.
3. Fatty tissue increase associated with generalized adiposity.

Hyperplasia of breast tissue elements.—This condition is the most commonly encountered disorder, particularly in the younger age groups.

During adolescence, there is frequently a bilateral, buttonlike

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thickening of tissue beneath the areola, which is a result of normal endocrine influences operating during this period. In the adult this thickening of breast tissue normally disappears. Should the enlargement continue, for reasons as yet undetermined, it may progress until similar in size and appearance to a well-developed female breast. Although frequently bilateral, this condition is more apt to be unilateral. Cases are recorded in the literature (*2*) in which breasts of this type when excised weighed over 1,000 gm.

Although the mass is directly under the skin, it does not cause puckering or wrinkling of the skin and is not firmly attached to the surrounding tissue. The swelling may be soft but is apt to be diffusely firm or dense and not painful unless there has been recent trauma. In the average case, the recognition of the lesion is relatively simple; however, cases may present themselves in which single or multiple nodules may be palpated within the diffuse mass. This may occur when a cystic dilatation of a duct or a fibro-adenoma is present. Such a nodule might be confused with a malignant tumor, and final diagnosis rests on the microscopic appearance of the tissue.

The role of the traumatic factor in producing this condition has been debated vigorously in the literature and many instances are cited in which trauma seems to be a definite etiologic factor. Although the question is still unsettled, it has been definitely noted that the trauma of carrying a pack, as in the Army, will aggravate a preexisting condition.

Pathology of diffuse enlargement of the male breast.—Most of the pathologic changes noted in the male breast are similar to those encountered in the female breast. The exceptions are engendered chiefly by the fact that histologically, the rudimentary male breast tissue does not contain acini such as occur in the female breast.

On microscopic examination of tissues removed from the diffusely enlarged breast due to tissue hyperplasia, any combination of the following pathologic changes might be noted:

1. Cystic dilatation of the ducts.
2. Proliferation of epithelium of the ducts, with or without cystic dilatation.
3. Edema of the stroma.
4. Increase in fibrous tissue.
5. Inflammatory infiltration.

Confusion in the literature on this subject has arisen, due to an inadequate common terminology to designate the combinations of tissue changes noted above. Various detailed systems of nomenclature have been evolved in an attempt to catalogue the pathologic pictures which result from the combination of elemental changes.

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For the most part, these numerous technical classifications are unimportant and bewildering to the clinician. The final disposition of these cases is similar in the entire group. However the following definite pathologic pictures are encountered:

1. Diffuse fibro-adenomatous hyperplasia.
2. Involutional hyperplasia.
3. Chronic cystic mastitis.

The pathologic condition in each instance is similar to the corresponding picture seen in the female breast. It is helpful when making a diagnosis to bear in mind the age groups in which these conditions are more apt to occur. Fibro-adenomatous hyperplasia tends to occur between puberty and the climacteric age; chronic cystic mastitis between the ages of 30 and 45, and involutional hyperplasia over the age of 45.

Treatment of diffuse enlargement of the male breast.—Many studies are now in progress to determine the exact role that endocrine disturbances play in the production of diffuse enlargement of the breast. Significant observations have been recorded and certain cases of breast enlargement seem to be a direct result of endocrine disturbances chiefly of the androgenic type. Scarff and Smith (*5*) report two instances of unilateral breast hypertrophy occurring in male factory workers where diethylstilbestrol was being manufactured.

In many instances, diffuse hyperplasia of the breast seems to be associated with testicular maldevelopment or atrophy or testicular tumors of the teratoid type (*3*). The examining physician should bear this possibility in mind and if such disturbances are found, should apply any possible corrective measure. In spite of the suggestive character of these observations, there has been as yet no conclusive evidence that endocrine therapy produces definite or lasting benefit.

A factor which modifies the treatment of men in the armed forces is now the accepted significance of the psychologic hazard which enlargement of the breast may create in the soldier or sailor. In the armed forces, where prompt correction of defects is imperative, the only practical treatment is surgical removal of the involved breast tissue by a simple mastectomy. Since the condition tends to recur, care must be exercised to be certain that all of the breast tissue is removed. Surgery is also necessary because of the possibility of error in the clinical diagnosis, thus permitting a malignant tumor to advance beyond the operable stage.

Diffuse enlargement of the male breast caused by local fatty infiltration (lipoma).—The incidence of lipomatous tumors occurring in the breast region varies extremely with different authors. White (*6*) has reported a case in which the enlargement due to localized fatty deposition simulated a normal enlarged female breast. The enlarge-

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nent may be diffuse or nodular with single or multiple masses. It is almost always unilateral and is soft. Microscopically these lipomas are similar to those found in other parts of the body. Treatment is simple excision.

Diffuse enlargement associated with generalized adiposity.—Generalized adiposity may give rise to large deposits of fatty tissue in the subcutaneous tissue of the breasts, so that a rather flat, bilateral diffuse enlargement occurs. Such a condition may be important in a serviceman because of its appearance. This condition is more apt to occur in Fröhlich's syndrome. Treatment should be directed at weight reduction, and operation should be considered only if the condition becomes extreme.

Malignant disease of the male breast.—Carcinoma is the most frequent type of malignancy found in the male breast. Other types of malignancy total less than 3 to 5 percent according to various authors. In general, the types of tumor encountered and their course are analogous to those noted in the female breast. A difference in behavior of practical importance lies in the fact that cancer of the male breast is usually diagnosed later and metastasizes more readily.

The relatively late diagnosis of cancer of the male breast may stem from the fact that men are apt to overlook or disregard minor abnormalities of the nipple or breast, whereas recent education of women pertaining to lumps in the breast leads them to seek early medical advice. Analysis of data reported in the literature indicates that the period between the appearance of symptoms and the diagnosis of the lesion is almost twice as long in the male as in the female (*7*). That cancer of the male breast metastasizes more readily than cancer of the female breast has been explained on the basis of the smaller amount of tissue the tumor must penetrate in order to reach the lymphatics.

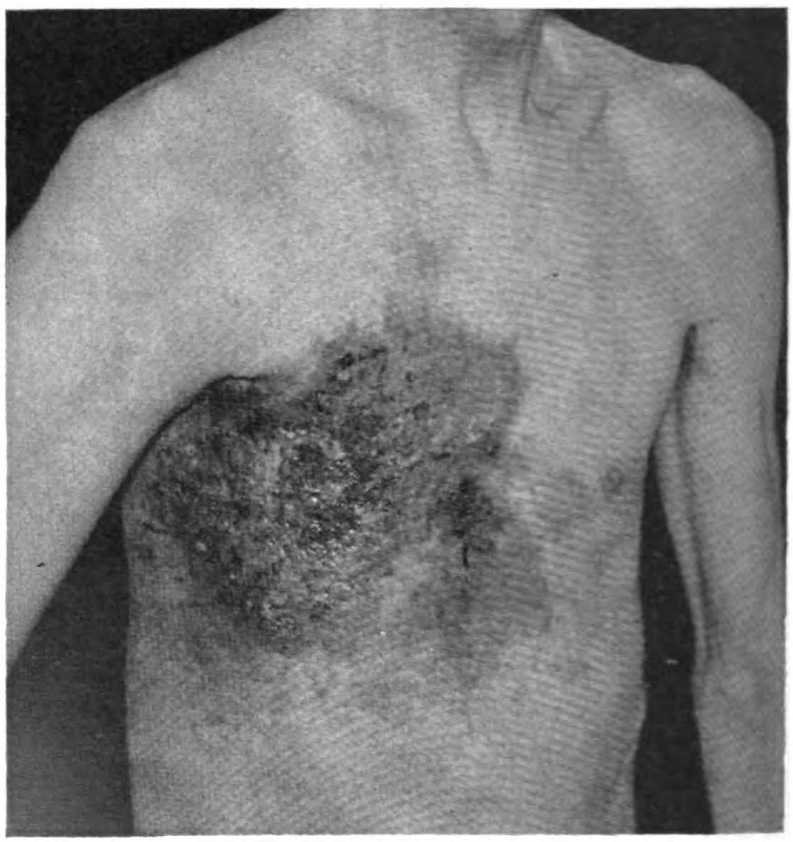
Relationship of trauma to carcinoma of the male breast.—Although male patients with carcinoma of the breast frequently give a history of trauma, it is probably not caused by trauma any more than is carcinoma of the female breast. Regardless of the factual quality of this relationship, it is well for the medical officer to bear in mind the possibility of carcinoma, and not dismiss lightly the injury to the breast which shows some reluctance to heal. A patient with an apparently simple injury of the breast should not be dismissed until the lesion has entirely disappeared, since a recent injury might mask a slowly developing underlying tumor.

Symptoms and signs of carcinoma of the male breast.—The principal manifestations of carcinoma of the male breast are listed below in order of decreasing frequency according to aggregate reports found in the literature (*3*) (*4*) (*7*).

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Pain.—This symptom may occur early, particularly when there has been an associated or preceding injury. In most instances, it is a late symptom but does occur in about 40 percent of all carcinomas of the male breast.

Nipple and skin retraction.—Because of the dearth of normal breast tissue in the male breast, the major portion of the growth is apt to be near the skin and nipple. Accordingly retraction of the nipple or dimpling of the skin probably occurs relatively frequently in



Male, 62 years of age. Carcinoma simplex. Appearance of lesion 6 months after first symptom. Death occurred 2½ months later from extensive metastases.

carcinoma. Statistics in the literature give this symptom an incidence of from 30 to 70 percent.

Bloody discharge.—This is a common symptom but reports of different series of cases give it an incidence of from 8 to 70 percent of all cases.

Ulceration.—This is a common finding and bears no relationship to the size of the lesion or its duration (7). The lesion as usually seen is a hard nodule or disc situated beneath or quite close to the nipple. It is usually slightly tender, unilateral, attached to the skin,

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t not firmly attached to the underlying tissue unless far advanced.

Types of carcinoma observed in the male breast.—A practical ıssification accepted by some pathologists and adequate for the inician will include adenocarcinoma, carcinoma simplex, and ucinous carcinoma.

Clinical course.—The significant feature of the clinical course of e male breast carcinoma is that it tends to metastasize more readily. his has been ascribed to the sparse underlying tissue separating the owth from the lymphatic channels. There is early spread to the gional lymphatics and progression of the lesion in a fashion analo- ous to the behavior in the spread of carcinoma in the female breast. he patient shown in the illustration is a good example of the rapidly reading characteristics of this type of cancer.

Treatment.—At the present time the consensus of treatment for ırcinoma of the male breast is radical mastectomy, provided the sion is operable. Radiation therapy seems to be an accepted proce- ure among most of the contributors to the literature, and it is recom- ıended that it be administered after the operation. In spite of adical measures the prognosis is poor, and even the best results ndicate only about a 50 percent 5-year survival (7).

Other lesions of the male breast.—Benign tumors are represented hiefly by fibro-adenomas. These are simply a variant of the fibro- denomatous hypertrophy mentioned above in which predominance f the fibrous tissue element gives rise to a tumor nodule of variable ize. The fibroma may be difficult to distinguish from carcinoma nd should be excised if only for diagnostic purposes.

Instances of myxoma, lipoma, chondroma, angioma and lymph- ngioma have been reported but are so rare as to be of interest only o the special investigator in this field.

Sarcoma constitutes less than 2 percent of all malignant tumors f the male breast.

Mastitis, either localized or associated with septic infection is rare. The features, course and treatment will follow closely along the lines f other inflammatory lesions or abscesses.

SUMMARY

The importance of the disorders which might occur in the male breast has been emphasized.

Emphasis has been laid upon the two most common conditions which might be encountered—diffuse hyperplasia of the breast and carcinoma of the breast. Their clinical and pathologic features and treatment are presented.

Whereas in civilian practice the diffuse hyperplasia of the breast does not demand immediate attention in every instance, it is impera-

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tive, if only because of the psychologic hazard involved, that the service man receive prompt and effective treatment to remove the condition.

Because of the rapid spread and high mortality with carcinoma of the male breast, the possibility of this condition occurring in any enlarged male breast should be kept in mind, and indicated diagnostic and therapeutic measures should be instituted immediately.

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CAUSES OF PAIN IN IMMERSION FOOT

In the early phase of inflammation, pain is due to anoxia of the injured superficial tissues and nerve endings. Pain of this sort can be controlled by cooling the legs, as this lowers cellular metabolism and makes the reduced demand for oxygen commensurate with the limited supply which can be furnished by the thrombosed superficial blood vessels.

After the period of inflammation has subsided, aching pain and rigidity of the toes may cause prolonged incapacity in persons with more severe injury from immersion foot. Microscopic examination of specimens removed for biopsy from skin, subcutaneous tissue and superficial muscle (extensor brevis digitorum) has shown that the pain and rigidity are due to an increase in interstitial connective tissue and collagen. It involves the blood vessels, muscle fibers and nerves. The last are embedded in fibrous tissue and show endoneural fibrosis as well. Pain of this type tends to clear after six to eight months, the period at which the collagen surrounding the nerves ceases to contract.—White, J. C., and Warren, S.: Causes of pain in feet after prolonged immersion in cold water. War Med. 5: 6–13, January 1944.

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POSTCONCUSSION SYNDROME

PATHOGENESIS AND PROPHYLAXIS

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A variety of syndromes can follow injury to the head. In military ervice many of these sequelae are sufficiently disabling to preclude he patient's return to duty. A study of comparable military and ivilian injuries (*1*) revealed that 20 percent of 237 patients with acute ead injuries in the fighting services were unable to return to duty, vhile in a group of 158 civilians only 8 (5 percent) had failed to return o work within 6 months.

The commonest of the various syndromes capable of following head njury is a presumed disturbance of the cerebral neurovascular system ordinarily referred to as the postconcussion syndrome. Its particular prevalence in wartime military practice is attributable to the fact that he clinical picture frequently has a functional coloring, and war and military service can play their own parts in influencing the course of the disease.

The syndrome includes an aggregation of symptoms which may follow any variety of head injury. Chiefly complained of are headaches and giddiness, usually associated with effort, emotion and alterations in posture. Easy fatigability and confusional states are frequently experienced. At times the giddiness is mistakenly referred to as "dizziness." Close questioning of the patient however frequently reveals that the symptom is in reality one of "things going black," i. e., faintness or "blackout." It is therefore important, in view of the difference in therapeutic indications that this condition be differentiated from true post-traumatic vertigo attributable to lesions of the vestibular apparatus wherein nystagmus, tinnitus and auditory impairment may be associated.

Though this syndrome is reversible in its early stages, it is capable of inexorable progression to profound deterioration if an unfavorable combination of circumstances allows. This involves predisposing factors which help to graft a psychoneurotic superstructure on a fundamentally organic substrate, which facilitates the development of neurotic behavior. These factors include the pretraumatic personality of the individual, problems of medical survey and compensation, the

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particular social and environmental situation in which the patient finds himself, the antecedent state of the cerebral vascular tree, and not of least importance, the management of the patient in the period following injury.

Typically, the extreme case of affective and intellectual impairment is characterized by the airmless individual with complete loss of initiative and interest. A previously mild-mannered and competent person may become irritable and slothful. All his efforts are exhausting, with the result that he is slowed up generally. Unless some associated post-traumatic syndrome coexists, the only apparent abnormalities on neurologic examination are in the emotional and intellectual spheres. This latter disturbance is not so much an intellectual deficit, as may be found in post-traumatic cerebral atrophy, from which it should be distinguished, but rather a disinclination to intellectual effort, particularly when involving the higher faculties, such as symbolization and judgment.

It is evident, from a consideration of this disorder, that the term postconcussion syndrome is unsatisfactory for a variety of reasons. For one, this particular disturbance follows other types of head injury as well as concussion. Munro's (*2*) suggestion of the term Post-traumatic State helps to meet this objection. It too, however, is overinclusive in not distinguishing this condition from other possible states following craniocerebral injury. Perhaps it would be desirable to add to an already overburdened nomenclature the term Post-traumatic Angio-encephalopathy to indicate the specific disturbance in the cerebral neurovascular system that may follow injury to the head.

Pathophysiology.—Though the pathogenesis of this disorder is not definitely established, the evidence of clinical studies suggests that, in the early stages at least, it involves a failure of the cerebral circulation to adjust itself to changes in posture. Hence the faintness or "blackout" so commonly observed. The headache mechanism too is presumed to be on a circulatory basis, and evidence has been adduced suggesting that this symptom is generally of a vascular origin, involving pressure or traction upon pain-sensitive vascular structures, the impulses from which are transmitted by the fifth, ninth and tenth cranial and upper cervical nerves (*3*).

Postural systemic hypotension is occasionally observed, but is not essential to the production of the syndrome, inasmuch as the prime alteration is attributable to a disturbance of intracranial vascular pressure. It is common knowledge that syncope is influenced by posture and may be alleviated by placing the patient in the head-down position. The measurement of human intracranial blood pressure and the effects of postural influence upon it can be inferred

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from studies of carotid pressure in the neck (*4*). Such investigations indicate that the tendency to lowering of the intracranial vascular tension with the assumption of the upright position is compensated for in the normal subject by appropriate adjustments in vasomotor tone. There is an initial fall, usually followed by a secondary rise of carotid arterial pressure. Syncope is apt to occur if this pressure drops to a level of about 20 to 30 mm. of mercury. The normal compensation of carotid pressure in the upright position does not occur in the arteriosclerotic subject.

The head-injured patient may fail to regain his erstwhile cerebral neurovascular control, partly for the reason that any patient who has remained flat in bed too long may suffer from this disorder on first getting up, and partly because the injury is of a specific intracranial nature. This latter factor, involving as it does a structure to which the individual attaches considerable importance in his experience, can encourage an undue preoccupation on the part of the patient with his head, which with other predisposing factors, may impart a neurotic coloring to the picture.

While a functional superstructure may aggravate or prolong the condition, initially its manifestations are probably organic, involving the cerebral vascular portion of the autonomic nervous system. In a sense therefore, this disorder may be considered as akin to the neurovascular disturbances in the sympathetic system, influenced by psychosomatic factors, such as Raynaud's disease and the affective type of hypertension. Anatomic and physiologic evidence is at hand pointing to the influence of vasomotor nerves on the cerebral vascular system. Penfield (*5*) has demonstrated nerve plexuses on the intracerebral arteries similar to those previously described on the pial vessels. Stimulation of one vagus nerve causes bilateral cerebral vasodilatation; while cervical sympathetic stimulation effects ipsilateral vasoconstriction (*6*). Vasodilatation can also be effected by efferent stimulation via the facial nerve (*7*).

Considerations such as these enable us to make the assumption that the postconcussion syndrome has a neurovascular basis. However the various predisposing factors which may contribute to the establishment of this disorder and give it a functional superstructure cannot be disregarded. Coming on at a time when an individual is subject to stresses and strains unusual to him, a head injury is capable of serving as the nucleus around which neurotic trends crystallize. At a period of satisfactory adjustment the same injury may be without sequelae.

While the pretraumatic personality of the patient appears to play a role in the origin and intensity of this disorder, there is as yet insufficient evidence that a personality predisposition is essential.

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The medical officer, nevertheless, should be on the alert for the possible development of this condition in an individual with a poor work record, who has not adjusted well in the service. That the antecedent state of the cerebral vascular tree is of importance is indicated by the greater tendency to this disturbance in elderly, arteriosclerotic subjects. This is probably to be explained, in part at least, by the failure of the normal adjustment of carotid pressure in the upright position in this type of individual. The matter of compensation, important in civil injuries, has its counterpart in service injuries in the question of early decision as to fitness for duty. Prompt adjudication by a Board of Medical Survey can favorably influence the course of the disorder, though it will not affect an underlying neurotic predisposition.

Management.—The problem of treatment of this condition once it is established, merits briefer mention than its prophylaxis. Much can be done to anticipate and prevent the disorder which, if once firmly fixed, is extremely resistant to therapy. Prophylaxis begins with the acute phaste of injury. The experience of the British (*8*) suggests that the incidence of sequelae following head injury is appreciably diminished by shortening the period of convalescence. It appears probable that the beneficial results secured in cases so treated are attributable to the early reestablishment of the patient's former cerebral neurovascular tone, and to the fact that the opportunity for preoccupation with his head is minimized.

It is of great importance to have the patient sit up in bed promptly, preferably as soon as consciousness has been regained. The immediate advantages achieved are the considerable reduction of intracranial pressure (*9*) and the diminution of cerebral venous pressure (*10*). Too long maintenance in the horizontal position tends to affect the tone of the cerebral vasculature, with the result that patients who have been kept this way are apt to complain that the head "swims" upon assumption of the upright posture. This is particularly evident in the head-injured patient, whose symptoms not infrequently are related to changes in position.

The principle of diminishing the patient's preoccupation with his head may be served by removing his name from the serious list once consciousness is regained, and by restricting his visitors to the usual number and hours. Furthermore those who visit should be advised not to discuss the patient's illness with him. Investigators of the circumstances of the accident should be denied access to the patient until he is able to be out of bed.

Diagnostic procedures which increase the patient's preoccupation with his head are generally ill-advised, though occasionally essential. Lumbar puncture should rarely be done more than once, and this preferably during the 2d or 3d 12-hour period following injury

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when maximal information is obtainable and for which the patient's subsequent recollection is perhaps not too keen. For a similar reason, it is advisable to administer adequate sedation to the patient in the event of his being too disturbed when the puncture is being performed. Suitable measures should of course be taken to minimize the possibility of post-puncture headache, which if present ought of itself be regarded as a contraindication to further tapping.

The presence of blood in the cerebrospinal fluid does not necessarily require lumbar puncture for its removal inasmuch as it has been shown that once active bleeding has ceased, blood will disappear from the fluid within 5 or 6 days regardless of whether punctures are performed or not and that not more than 10 drops of whole blood are removed by an entire series of punctures (*11*). Rarely is puncture needed for the reduction of intracranial tension. A too rapid or excessive reduction of pressure is apt to be less well tolerated than a moderate increase of pressure which is maintained. While skull x-rays are usually not necessary soon following injury, such studies nevertheless ought to be completed well before the patient's discharge, preferably once he is up in a chair.

It has been suggested that slight headache of itself should not constitute a contraindication to getting the patient out of bed early (*8*). This is largely a matter of individualization. A man whose cerebral injury involves no more than simple concussion, or low-grade edema and congestion, can generally be allowed up after 24 hours. In most instances the initial confusion and drowsiness, and maximal intensity of headache will have then passed. The individual with a cerebral contusion or laceration naturally requires more time for his lesion to heal and does better with a longer period of absolute bed rest.

A patient who is remaining in bed more than is obviously necessary because of his headaches needs appropriate reassurance. He should be told that such symptoms are not unusual or disabling and can be expected to clear up. It should be made clear that the inevitable healing of his lesion is paralleled by comparable improvement in his condition. If the skull is not fractured such knowledge may prove very reassuring to the patient, particularly in view of the special importance attached by the average person to this component of his injury.

Occasionally, localized post-traumatic headache due to scalp contusion may delay recovery and even encourage the development of the postconcussion syndrome. It should therefore be treated where possible if the principle of accelerated convalescence is to govern. In our experience this is most apt to occur with temporal lesions, presumably a result of the confluence of the zygomatico-temporal and auriculotemporal nerve fibers along with the sensory fibers carried by the temporal artery. Should such headache persist, following subsidence of

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the swelling, it can then be treated effectively by local block with procaine.

Once the patient is sitting up out of bed he should be encouraged to mingle with other patients, and to remain up as long as possible without becoming fatigued. Not infrequently one finds that a patient has been quite comfortable while sitting up the entire day, but complains of "dizziness" some time after being put back to bed in a side room, and the opportunity for introspection has set in. It is of importance, therefore, to have such a patient out of the quiet room and in the ward as soon as practicable, preferably beside another head-injured patient who gives every indication of an early recovery.

The patient is allowed to walk a day or two after first sitting up in a chair. Such an effort may be exhausting and cause giddiness and profuse perspiration when first undertaken. This transition has to be gotten by judiciously. It may be found that the administration of benzedrine will increase the patient's inclination and capacity to walk and is worth a trial in resistant cases. He should wear his uniform and dispense with aids such as crutches and canes unless they are essential.

A period of supervised graduated physical therapy follows, having for its objective the achievement of a state of physical hardening appropriate to the return to duty. Postural bending exercises are of particular value because of their favorable effect in adjusting cerebral vascular tone to changes of position. Graduated mental exercises need not be stressed in this phase unless a complicating intellectual deficit coexists.

The time required for the resumption of former activity may vary from a few days to many months, depending in a varying manner upon the extent of the initial injury and the previously mentioned factors predisposing to prolonged convalescence. The existence of such an unfavorable combination of circumstances is mitigated by the establishment of a satisfactory rapport between doctor and patient. Psychiatric study is indicated if it becomes evident that the patient's recovery is slower than is justified by the known cerebral lesion. The sheltered environment of the hospital, while serving temporarily to detach the patient from his stresses, can if unduly prolonged make rehabilitation more difficult. For this reason, early assessment of his outlook is important and prompt decision as to return to duty or discharge from the service is indicated.

Once the disorder becomes chronic and serves as the nucleus on which a psychoneurosis fastens itself, the prognosis is usually not good and the results of treatment are apt to be discouraging. On the basis of the vasomotor concept of the origin of this disorder, prostigmine has been used with encouraging results (*12*). As noted by

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Denny-Brown (*13*) an analysis of this work suggests that some benefit from the drug may also be expected in cases of post-traumatic disturbances of the vestibular apparatus. The beneficial effects of prostigmine are attributable to its vasodilator properties secured through enhancement of acetylcholine activity by inhibition of cholinesterase. Such treatment is directed toward the organic fraction of the chronic syndrome.

Effective rehabilitation also requires attention to the facilitation of readjustment on the part of the patient to his former environment. This will necessitate psychiatric collaboration and possibly social service aid, such as is available through the Red Cross. The externalization of the patient's interest and the redevelopment of his skills through supervised graduated physical and mental activity form an essential component of the therapeutic regime. In Naval practice such therapy is indicated only if the injury did not antedate enlistment. Otherwise it is best to survey the patient. If no definite psychoneurosis has been grafted on the organic substrate, the patient can be given a trial at duty. He should be surveyed promptly however if symptoms persist.

COMMENT

Recent statistical evidence furnished by Shearburn and Mulford (*14*) based on a follow-up study of 90 uncomplicated and complicated cases of acute head injury, points to the soundness of treatment by accelerated convalescence. Our experience during a period of 9 months prior to the submission of this report in the management of acute head injuries seen at a Naval hospital associated with a large training station, where it was possible to maintain contact with the patient in the event of sequelae developing, tends to support this view. None of these individuals was readmitted as a result of having previously sustained a head injury.

This would confirm the rapidly gaining general impression that the interests of the head-injured are best served by a shortened period of convalescence. A tendency to deny hospitalization to trivial-appearing head injuries because of the apparent success of this method should be discouraged, however. A period of 24 to 48 hours in the hospital is desirable in such cases. It will enable the patient to get beyond the incubation period of an extradural hemorrhage and will offer the opportunity for satisfactory reassurance before the solicitude of friends, relatives and investigators encourages introspection. And finally it is of importance in establishing a detailed written medical record of the circumstances associated with the accident and the resultant condition of the patient in the event that such information is subsequently needed.

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It may be suggested that the validity of such a regime is negated by the appearance of the postconcussion syndrome in patients who were never hospitalized for their injury. Experience with this condition shows that its initial management is apt to have followed one or both of two general patterns, either a story of the patient having been kept flat in bed in the hospital for a period of three weeks, during which time many lumbar punctures were performed, or having been subject to the well intentioned but dubiously beneficent solicitude of friends and relatives at home. If the dual conception of impaired cerebral vascular tone and preoccupation with one's head is valid, then it would appear that the patient can suffer from too much or too little hospitalization.

SUMMARY

1. The commonest syndrome following head injury, that consisting essentially of headaches and giddiness influenced by posture, emotion and effort, presents a pertinent problem to the medical officer confronted with the task of returning the head-injured patient to duty.

2. The disorder is conceived of as a dual disturbance involving the cerebral vascular portion of the autonomic nervous system, and influencing psychogenic factors, i. e., a post-traumatic angioencephalopathy.

3. Of greatest importance in influencing the onset of this disorder is the type of initial management instituted while the patient is still in the hospital. Predisposing factors include the antecedent pretraumatic personality, social and environmental influences, and the state of the cerebral vascular tree.

4. During the period of hospitalization, it should be the medical officer's objective to hasten recovery by measures designed to facilitate the early restitution of the patient's former cerebral neurovascular tone, to minimize preoccupation with his head and externalize his interests as early as possible.

5. Diagnostic procedures such as lumbar puncture should be kept to the bare minimum required for efficient handling.

6. Discussion between the patient and investigators, relatives, friends, and similar interested parties of the circumstances of the accident should, if at all possible, not be permitted until he is out of bed and asymptomatic.

7. Since the syndrome appears to be evoked not only by injudicious hospitalization, but also by home treatment and the solicitude attendant upon it, it is desirable that even apparently trivial head injuries receive 24- to 48-hour observation in the hospital. This also makes possible an accurate, written medical record of the circumstances of

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the accident and the effect upon the patient, allows an opportunity for needed reassurance, and encompasses the usual incubation period of an extradural hemorrhage.

8. The prognosis in the chronic, deteriorative phase of this disorder is poor. It should be anticipated and treated before this stage is reached.

9. Survey from the service is indicated in cases of the postconcussion syndrome where the injury antedates enlistment and the patient fails in an initial trial at duty.

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CORNEAL GRAFT OR TATTOOING WITH IRIDECTOMY?

WITH A BRIEF REPORT ON CORNEAL STUDIES AFTER ELECTROCUTION

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In the past several years keratoplasty has attracted much popular interest and as a result many blind persons have sought a transplant operation in the hope that their sight could be restored. Unfortunately the majority of these people are doomed to disappointment because most cases of blindness are due to causes other than opaque cornea. Moreover only a comparatively small number of operations upon acceptable subjects for transplant have proved visually successful.

In view of these facts, it is interesting to investigate several practical features of this operation, the demand for which is becoming increasingly urgent.

Indications.—Most eye surgeons agree that keratoplasty is indicated whenever a corneal opacity is the major cause of very poor vision. This criterion however is essentially too general. It should be more accurately stated that an eye basically blind from a complete corneal opacity whether superficial or deep, is entitled to the benefit of a corneal graft. The word complete is used advisedly. As long as there is a small area of reasonably clear cornea present in the interpalpebral fissure, the operation of choice is not keratoplasty, but rather, corneal tattooing, followed by an optical iridectomy. In most instances of corneal opacity there is an area of clear, or suitably clear, membrane present. Diffuse dense opacity completely covering the cornea is rare. Therefore, keratoplasty seldom is indicated.

According to Von der Heydt, "To assure a permanent transparency of clear implanted corneal tissue, the window must be imbedded within a partly clear stromal area of the host's cornea. Transplants placed within leukomata soon become clouded" (*1*). If this, indeed, has been the experience of all other surgeons, then corneal graft practically never is to be recommended.

It is to be noted that the latter operation is not free from danger. It requires some degree of skill, and in the hands of the most expert surgeon is still delicate surgery. Therefore a more simple procedure should be welcomed. If the technic carries with it a very high per-

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centage of success, greater than that of the most optimistic reports on keratoplasty, then it is even more desirable.

After a complete study of 96 corneal transplants, Filatov, a pioneer of the present day technic of keratoplasty, reported that only 14 preserved a permanent transparency of the graft. On the other hand, Castroviejo states that when the operation is done on favorable eyes, over 85 percent of the transplants will remain clear. Given eyes with more advanced corneal opacity, including eyes of certain groups classified as unfavorable for transplant, it is reasonable to expect that over 96 percent will show visual improvement following the operations of corneal tattooing and optical iridectomy. In the present small series of cases there was 100 percent success.

Contraindications.—Another feature of this combined procedure is that it vitiates several of the contraindications for keratoplasty. So long as there is a comparatively clear corneal area present within the interpalpebral fissure this procedure is indicated. It makes no difference if the leukoma be dense, if the patient be aphacic, or if he suffer from glaucoma. As a matter of fact, in the latter condition, the optical iridectomy will also serve as a therapeutic iridectomy, performed separately or in conjunction with any of the filtering operations.

Spaeth (*2*) describes the surgical procedure of tattooing of the cornea with optical iridectomy. For a number of years it has been employed successfully by me on eyes primarily blinded by an incomplete corneal opacity which entirely occluded the pupillary area. The present experience includes approximately 16 patients. In 6 the eyesight has been corrected from industrial blindness before surgery to favorable acuity after the operation, that is from 20/200 and 20/100 to 20/30 in 4 and to 20/20 in the other 2 patients.

As is well known, a corneal macula or leukoma over the pupillary area gives rise to great diffusion of light within the eye. It acts as a frosted glass before the normal eye. In place of the normal refraction of the light rays onto the macula of the retina, there is widespread dispersion of the rays at all angles. This phenomenon produces blurred images, with resulting reduced vision. Visual acuity in these patients varies with the density of the opacity. If this opacity could be converted from one which transmits dispersing pencils of light throughout the eyeball, to one which will absorb the light rays, then a disturbing element in the production of good vision would be eliminated. Tattooing achieves precisely this end.

Black or brown is the color to be employed. Of course, the pupillary area is always tattooed black, whereas opacity over the iris may be colored dark brown, or given a lighter shade in the presence of a blue iris. Cosmetically the results are good. In some cases, two colors have been tattooed at the same time. The central pupillary area was

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painted black while the contiguous, more peripheral cornea was given a brown tint. The operation regularly meets with success in favorable eyes. As for the various procedures, they can be found in any standard book on eye surgery. Hydrazine hydrate or epinephrine is used for the reducing agent, according to the desired tint.

It should be mentioned that a central corneal opacity encroaching on the pupillary area, but not completely occluding it, may interfere with the patient's sight. There may be a mild loss of vision. When the opacity does interfere, tattooing of this area is indicated. The tattooed surface not only may improve the appearance, but also will absorb the troublesome, intra-ocular pencils of light and reduce the size of the transparent pupillary area. By reducing the size of the pupillary area, there is created a condition comparable to a contracted pupil. Increased sight results from the fact that some of the annoying peripheral rays are obstructed. Instead of developing spherical aberration, with consequent reduced acuity, these rays are absorbed. Often, in these patients, tattooing will give both subjective and objective visual improvement.

Permanency of the dye.—Several of the eyes still retain sufficient pigment after 4 to 7 years. Should an eye lose a good deal of the coloring, the simple tattooing operation may be repeated.

After the eye has become quiet, an optical iridectomy is then carried out. The area for the operation is carefully chosen, after a thorough study of the cornea and iris, including corneal microscopy. When the size and location of the opacity permit, it is advisable to dilate the pupil and study the visual acuity of the eye through a stenopaic slit or pin-point diaphragm, adjusting this to various positions until the corneal area of maximum vision is discovered. To be sure, the site selected should be within the interpalpebral fissure. Then a small, rather than a large, optical iridectomy is performed.

In the event that the only clear corneal area is occluded by the upper lid, primary blepharoplasty is to be considered. With a wider interpalpebral fissure, the transparent portion of the membrane may be exposed, thus insuring the outcome of the subsequent surgery.

With a peripherally placed pupil there is a little distortion of the macular image. Corneal opacities, too, may interfere with the vision by virtue of the astigmatism induced. The degree of the astigmatism is dependent upon the extent, the depth, and the density of the opacity. A peripheral optical iridectomy in these patients has given them comparatively good vision. In a small percentage of cases it may be necessary to resort to orthoptic training to better the visual result. It is felt that this surgical procedure also will be of benefit in a central, localized cataract, with the opacity covering the pupillary area. The annoying diffusion of light, with its consequent loss of vision, is abol-

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shed by the tatooing, while the new pupil permits new-found eyesight.

Source of material.—Investigation of over thirty human eyes secured after electrocution for criminal offense, has indicated the suitability of these corneas for grafting. Clinical, thermometric, ophthalmoscopic and microscopic examinations were done. The findings demonstrated that the cornea after electrocution undergoes very little change, and therefore it probably could be used to advantage as the donor graft in keratoplasty.

Another point which well might be mentioned is that corneal graft has been proposed for advanced cases of keratoconus. Apart from the danger of the operation, keratoplasty will not cure the underlying metabolic disorder which gives rise to a bulging of the entire cornea, not a bulge confined to the central area. Rather in the author's experience vitamin D and calcium are the essential therapeutic agents (*3*) (*4*). Marked improvement in vision has resulted from their use. In these eyes with large corneas, actual shrinkage of this transparent membrane has been proved beyond question by the taking of plaster of paris casts of these corneas before and after treatment. Accurate measurements were made to the ten thousandths of an inch. The conical corneas also became flatter.

CONCLUSIONS

Corneal tattooing, followed by optical iridectomy, is the surgical procedure of choice in an eye primarily blinded by an incomplete corneal opacity. Markedly improved vision generally is obtained.

This combined surgical procedure is simpler than corneal grafting. It is far less hazardous and is more uniformly successful. It has a wider application, since it vitiates several of the contraindications for keratoplasty.

Corneal grafting seldom, if ever, is indicated.

In the presence of a corneal opacity partially covering over the pupillary surface, and causing reduced vision, tattooing of the affected area will improve the eyesight.

Corneal tattooing can remain effective for at least 7 years.

Eyes after electrocution may be suitable for corneal graft.

Before considering surgery in advanced cases of keratoconus, or in fact, for any case of conical cornea, it would be well to prescribe comparatively high doses of vitamin D and calcium.

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NYSTAGMUS

Nystagmus, coming from the Greek "to nod," is best defined as a "rhythmic associated movement of both eyeballs." It is "rhythmic" because it consists of a motion that is to and fro, each movement following the other in sequence; and "associated" because both eyeballs participate in this action. The types may be classified as:

I. Nystagmus of vestibular origin.
  A. Physiologic (induced).
    1, Rotational. 2, Caloric. 3, Galvanic. 4, Of fistula test.
  B. Pathologic (spontaneous).
    1, Of Labyrinthitis. 2, Paralabyrinth irritation. 3, Of vestibular nerve irritation.
II. Nystagmus of optic origin.
  A. Physiologic.
    1, Optokinetic (or railroad). 2, Voluntary (extreme position).
  B. Pathologic (spontaneous).
    1, Relating to dim light (acquired).
      a, Miner's nystagmus. b, Spasmus nutans.
    2, Due to impaired vision.
III. Nystagmus of neuromuscular origin.
  A. Physiologic.
    1, Extreme position.
  B. Pathologic.
    1, Weakness of extraocular muscles.
IV. Nystagmus of cerebellar origin.
  A. Lesions of the cerebellum.
  B. Involvement of cerebellar connections in the brain.
  C. Pressure by tumors of the cerebellum on Dieter's nucleus or the medial longitudinal fasciculus.
  D. Lesions of the vestibulo spinal tract.
  E. Veli palatini.
V. Nystagmus of cerebral origin.
  A. Cortical. B. Pendular. C. Retractorius. D. Spontaneous vertical.
VI. Nystagmus of uncertain origin.
  A. Physiologic.
    1, Voluntary (induced).
  B. Pathologic.
    1, Toxic states. 2, Disease of the cervical region of the spinal cord. 3, True fixation.

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STEREOROENTGENOGRAPHY

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ıas been generally accepted that to obtain stereoroentgenograms ıbe shift depends on the focal film distance. Methods based on ɔrinciple are derived from stereophotography and when applied to ɔroentgenography usually result in tube shifts that are too great. result of investigations by Klein and his coworkers [1] this has been ɔd fallacious because the basic principles of stereophotography ɔt apply to stereoroentgenography. In the latter, instead of a ɔf stereo pictures such as would be obtained with a stereo camera, ctual result from stereoroentgenography is a pair of pictures of a ɔw. Figure 1 illustrates this point. Stereoroentgenography however conform to the laws of stereoptics to the extent that there not be too much displacement of the shadows on the two stereo-genograms, or when they are viewed in a stereoscope they will not properly. This is especially true inasmuch as there are many ɔws portrayed on the stereoroentgenograms from different depths ı anatomic part.

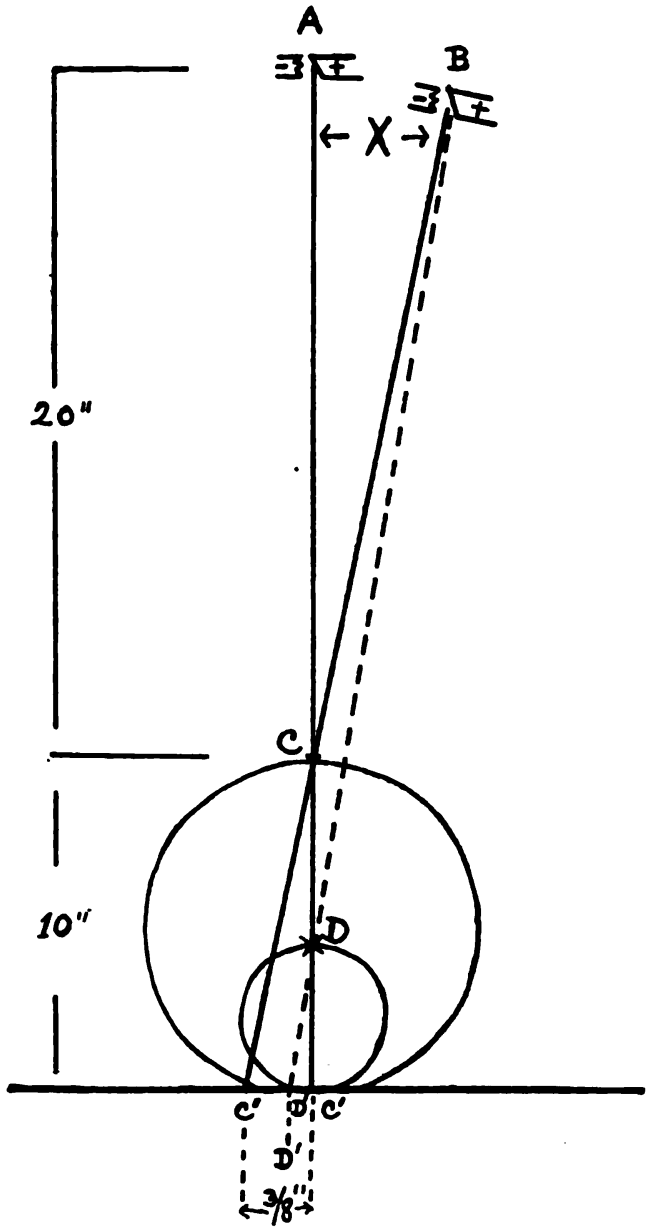
e investigators mentioned found by trial and error method that ıe largest percentage of all the individuals tested less than 3/8-inch acement of any shadow within the depth of the anatomic part most complementary to depth perception. Working with this ıardized principle it is necessary to shift the x-ray tube a given nce for the depth of the part so that no shadow within a given ı will have more than 3/8-inch measured displacement.

lculation of the correct displacement of the tube is best explained ıoting (with permission) from the authors cited, with adaptation r revised drawings.

shadow of the part of the object nearest the roentgen tube and farthest from the film is displaced the greatest distance when the roentgen tube is l. Thus in graph 1 the shadow of C has a greater displacement than the w of D. Moreover, the farther the object is away from the film, the greater e its displacement. But as explained, the shadows thrown by C must not

[1] KLEIN, E.; KLEIN, M.; KLEIN, H.; and NEWMAN, A. T.: Investigation into some practical aspects of roentgen-ray stereoptics. Am. J. Roentgenol. 49: 683–690, May 1943.

be greater than ⅜ inch apart. If, then, it is arranged that no matter what distance C is away from the film, the displacement shall be *not more* than ⅜ inch, then the shadows of all other points will have less displacement than ⅜ inch and



Graph 1.—*A*—x-ray tube in first postion; *B*—x-ray tube in second position; *C*—plane of object farthest away from datum plane; *D*—plane of object nearest datum plane; *D'C'*—shadows of planes C and D projected by x-ray tube B; ⅜'' maximum disparity between any shadows within the object; *X*—x-ray tube shift to produce not more than ⅜'' disparity within the total depth of the object; *20''*—focal part distance; *10''*—part thickness. (*Illustration adapted from Klein, Klein, Klein, and Newman.*)

thus be readily fusible. In other words, the maximum amount of displacement being fixed, the amount of movement of the tube has to vary for each object to be roentgenographed. This distance can be calculated very simply. For example:

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In graph 1, ⅜-inch displacement of the shadow of C is required.

	Inches
Most distant point of object from film	10
Anode to point of object	20
Film-anode distance	30

Then ⅜ : 10 :: X : 20. Therefore X = ¾ inch.

Thus ⅜-inch displacement will be obtained if the roentgen tube is moved between each exposure, a distance of ¾ inch in a horizontal straight line.

PRACTICAL APPLICATION OF PRINCIPLE

The thickness of the part to the table is measured and the tube shift determined for the desired focal table distance (table 1).

TABLE 1.—*Tube shift chart*

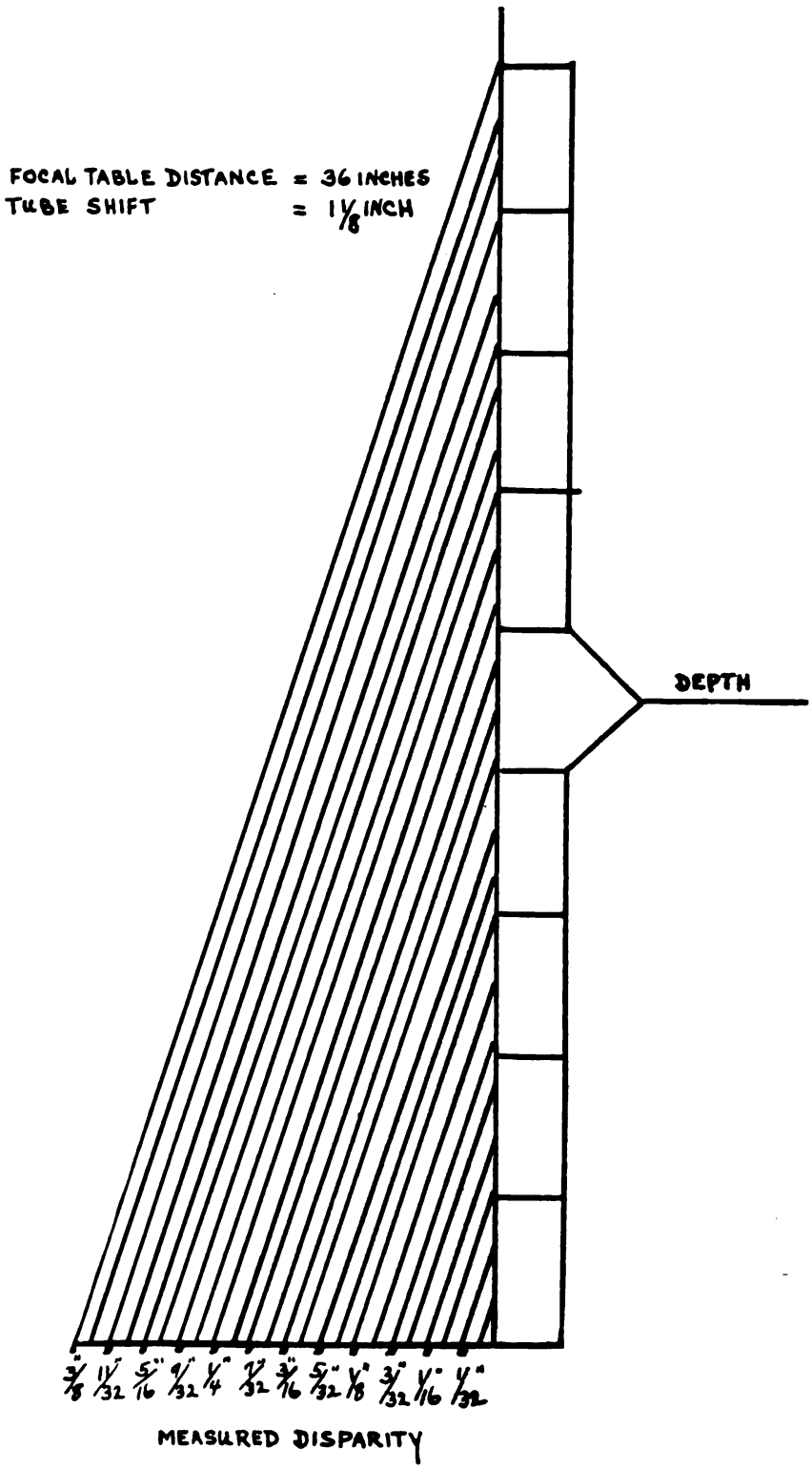
Part thickness (inches)	Tube shifts, focal table distances (inches)			
	30	36	42	72
	(*Inches*)	(*Inches*)	(*Inches*)	(*Inches*)
1	10⅞	13⅛	15	--------
2	5¼	6⅜	7½	--------
3	3⅝	4⅛	4⅞	--------
4	2½	3	3½	--------
5	1⅞	2¼	2¾	5
6	1½	1⅞	2	4⅛
7	1⅜	1½	1¾	3½
8	1	1 15/16	1⅜	3
9	⅞	1⅛	1⅛	2½
10	¾	1	1⅛	2¼
11	⅝	⅞	1	2
12	½	¾	⅞	1¾
13	½	⅝	¾	1½
14	⅜	½	⅝	1½

The majority of stereoroentgenograms are made with the anatomic part approximately 1 inch from the film because of the construction of the tunnel or Bucky diaphragm. For this reason it is not desirable to place any standard film markers on the cassette, as when viewed in the stereoscope such a marker would be a considerable distance from the anatomic part. The film marker should be placed on the table beside the anatomic part where it will appear in the same plane with the distal portion of the anatomic part when stereoscoped. This plane can be considered the datum plane.

Stereo films with the datum plane marked will have an additional value as the markers can be superimposed and considered as zero. The displacement of any shadow on the stereoroentgenograms can then be measured, whether bony structures, soft tissue masses or opaque foreign bodies, and the depth calculated (graph 2).

The focal table distance should be standardized to minimize variables. The tube carriage should be marked off in ⅛-inch divisions for crosswise shifts and the tube-rail in ⅛-inch divisions for lengthwise shifts.

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Graph 2.—Foreign-body localization.

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ıe first film should be exposed with the central beam centered ght angles to the film. The tube may then be shifted the pre- ed distance in the direction desired (lengthwise or crosswise) exposure of the second film. The only difference between this the usual procedure for stereoroentgenography is that the total is in one direction. It may be to either side depending upon the erence of the roentgenologist.

ıe tube shift chart (table 1) has been arranged for the most ılar of the tube distances in use today. If desired the tube shift intermediate tube distance may be calculated by applying the ıula previously cited for calculating the correct displacement of tube. The tube shift distances are to the nearest $\frac{1}{16}$ inch, and ıere is a question of increasing or decreasing the specified tube for best results, the lesser is used. This is directly opposite ıe usual practice.

ıe focal table distance is used rather than the focal film distance ıat it will not be necessary to calculate the distance between the e top and the film. This is important in order that all calcula- s can be standardized from the same point.

he thickest point of the anatomic part is measured to the nearest above the actual measurement within the field, using the table as the most distant point from the x-ray tube. For example, part thickness should be six-and-a-fraction inches, use the tube t for seven inches of part thickness.

he tube shift depends on the anatomic thickness and the focal e distance, for successful stereoroentgenography. It has been ıted out that until recently the tube shifts have been too great. s has caused too great disparity between the shadows on the two s of the stereo pair, preventing good fusion. For best results the y tube should be shifted a lesser rather than a greater distance the thickness of a part at a given focal table distance.

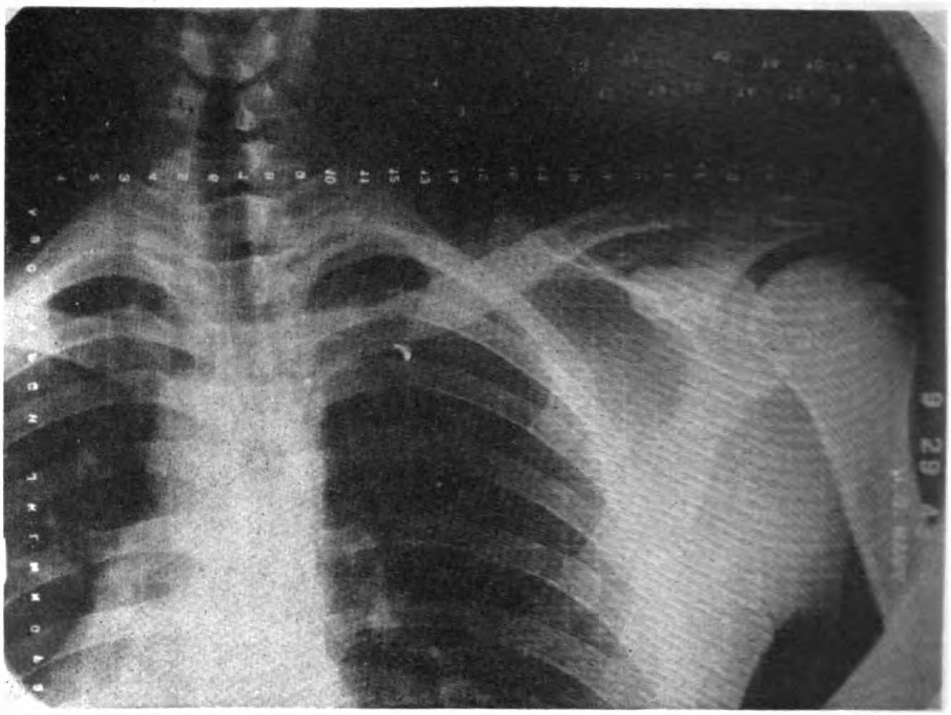
Vhen the part thickness has been measured and the focal film ance selected, the table is consulted for the proper tube shift.

o use stereoroentgenographs for foreign-body localization the ım plane must be marked, and the tube shift for a given part kness at a selected focal table distance must be known.

he datum plane represents the plane from which all calculations made. The anatomic part being radiographed rests on the ım plane, and its thickness is measured from this point. The l table distance is also measured from the datum plane.

s pointed out previously the datum plane should be marked dis- tly. The usual film marker containing the case number, date, etc. serve for this same purpose.

To calculate depth the processed pair of stereoroentgenograms are superimposed, using the datum-plane marker as the index and measuring the disparity between the shadows of the foreign body. Depth at a selected focal table distance is calculated as follows: The part thickness is known and the tube shift is a distance that will not displace the shadow of any object within this depth more than 3/8 inch. For example, if the part thickness is 9 inches and the selected focal table distance 36 inches, the tube shift for these factors will be 1⅛ inches. The measured disparity between the shadows of a foreign body portrayed on the stereoroentgenograms is



A single film of a stereo pair used for foreign-body localization. The letters and numerals at right angles to each other demonstrate a method of labeling the horizontal grid. The numerals seen in the upper right-hand corner of the radiograph represent the vertical depth grid.

found to be 3/16 inch. With these known factors the solution is a matter of simple proportion:

3/8 inch	known disparity for 9 inches part thickness at 36 inches focal table distance, with 1⅛ inches tube shift.
9 inches	part thickness.
3/16 inch	measured disparity of the shadows of the foreign body
X	depth of foreign body.

3/8 : 9 : 3/16 : X.

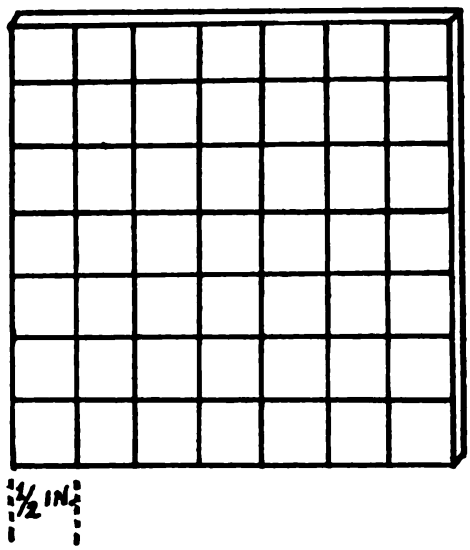
X = 4½ inches.

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The foregoing procedure affords a reasonable degree of accuracy when employing routine stereoroentgenograms, but if a large amount of foreign-body localization work is being done by the x-ray department certain refinements in technic should be employed. These include: (1) A simple horizontal grid to mark the datum plane; (2) a vertical stepladder or other type of grid to give a comparative depth perspective when the films are stereoscoped; and (3) a chart with standardized factors.

Thin wires embedded in a sheet of radioluscent material, the wires spaced ½ inch apart and running crosswise and up and down. These form a simple horizontal grid (graph 3).

For the vertical stepladder, steps ½ inch in height are sawed in a block of hardwood. A lead numeral is embedded in each step to designate each level (graph 4).



Graph 3.—Horizontal grid (datum plane).

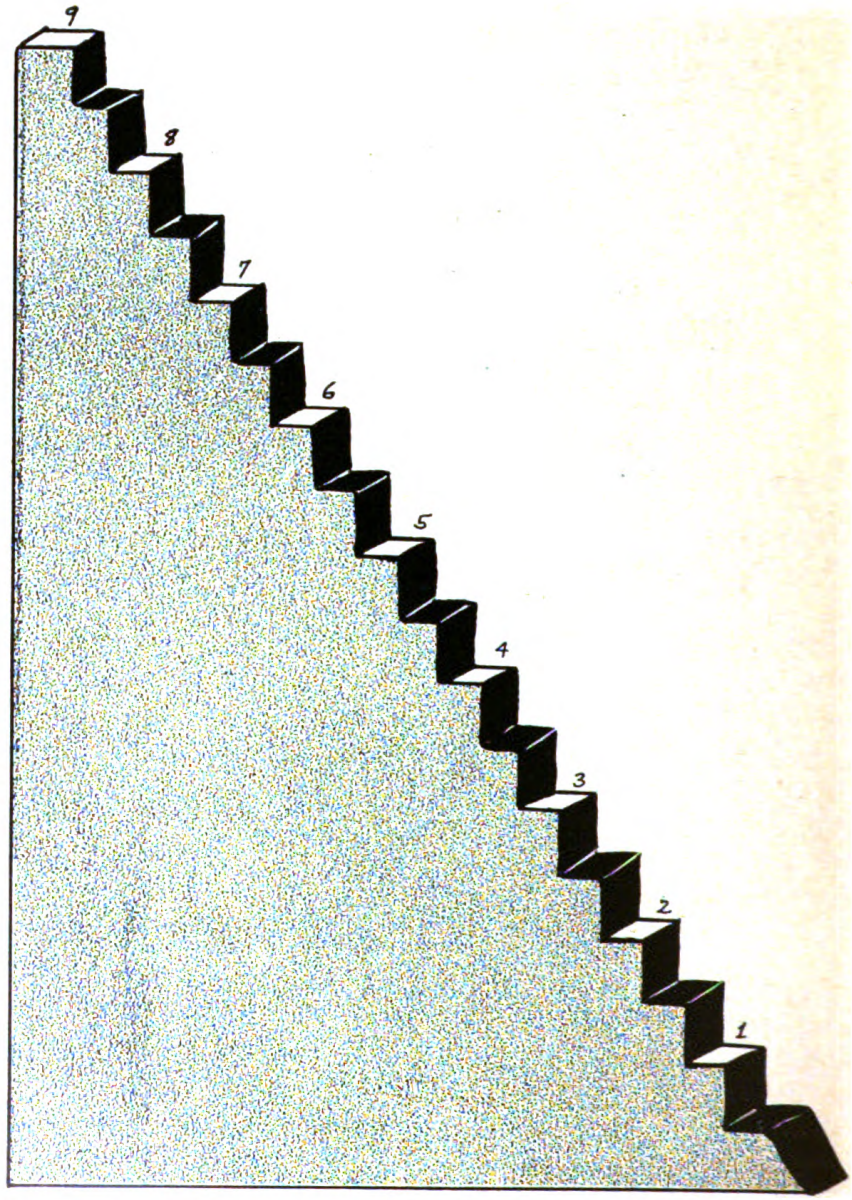
Standardized foreign-body localization chart.—This chart has been arranged for a standardized focal table distance, tube shift, and thickness of the anatomic part. Regardless of the actual thickness of the part, a tube shift for 9 inches of tissue thickness is used.

Stereoroentgenograms, standardized on these factors, when superimposed with the datum plane as the index, will produce a measured disparity that can be applied to the chart to ascertain the depth of the foreign body. Examination of the chart will show that it is so arranged that for $\frac{1}{64}$-inch disparity there will be $\frac{3}{8}$-inch depth.

Practically it has proved desirable to use a bony landmark rather than the skin surface for the spatial relationship of the foreign object, since the skin and soft tissues are both freely movable and compressible. For example if the disparity of the foreign body is

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$\frac{3}{16}$ inch and the disparity of the bony landmark is $\frac{1}{4}$ inch, the difference is $\frac{1}{16}$ inch or $1\frac{1}{2}$ inches in depth away from the bony landmark.



Graph 4.—Vertical depth grid.

In conclusion, the technic described has been successfully employed by us for all stereoroentgenograms. In routine stereo studies our experience has been that stereo vision is more completely and diagnostically obtained than by the generally accepted method.

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CLINICAL NOTES

ACUTE SUPPURATIVE ETHMOIDITIS WITH ORBITAL ABSCESS AND SEPTICEMIA TREATED WITH PENICILLIN

OTTO W. WICKSTROM
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and
HOWARD M. HEBBLE
Lieutenant (MC) U. S. N. R.

Primary infection of the ethmoidal labyrinth is common, as pus often develops in the ethmoidal cells without infection of the frontal or maxillary cavities.

Suppuration may be closed or open, and in the case reported here both occurred. The closed cells eroded rapidly into the orbit with ensuing orbital cellulitis. Blood stream infection followed with its toxic symptoms. The offending organism, Staphylococcus aureus, was obtained in pure cultures from the nasal drainage, the blood stream and later from the orbital abscess.

The failure of sulfadiazine to halt this rapidly advancing organism prompted the use of penicillin. The course of the disease then changed from almost certain fatality to the gradual recovery that can best be described in the case history.

CASE REPORT

The patient, aged 20 years, was admitted to the hospital on 20 October 1943. He was ambulatory and had been mildly ill with a head cold for the past 5 days. He also complained of pain in the left cheek and at the inner canthus of the left eye.

He had had recurrent attacks of sinusitis since childhood, but none as painful as the present one.

Examination made on admission revealed a temperature of 100° F., pulse 90, and respirations 20. Nasoscopic examination showed the turbinates and nasal mucous membranes acutely inflamed and mucopurulent discharge from both middle meatuses. The left upper eyelid was slightly swollen and some limitation of motion was present. The pupils reacted to light and accommodation and the ocular movements were normal. There were no neurologic signs evident and the remaining general examination was negative.

By the following afternoon the temperature was 105° F. There was a marked cellulitis of the left orbit, spreading edema of the left forehead and tenderness of

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the scalp. The ocular movements were somewhat limited by the swelling. The patient had become stuporous and the leukocyte count was 26,000. Nasal and blood cultures showed pure Staphylococcus aureus. The left maxillary sinus was irrigated and found clear. Portable roentgenograms showed the left frontal sinus uninvolved and the left ethmoid dense. Intranasal turgescence on the left side had greatly increased and poor sinus drainage was evident.

Despite the use of a total of 310 grains of sulfadiazine, in addition to blood transfusions, during the first 2 days of therapy the patient's condition was unimproved. The temperature remained at 105° F. The previous picture of mental confusion, stupor, spreading edema of the forehead, and tender scalp was added to by the appearance of a local soft spot in the left frontoparietal scalp area and a definite word aphasia. The ocular fundi were essentially negative.

On 22 October the causative organism was found susceptible to penicillin in vitro. Sulfadiazine was then stopped and penicillin started. The dose of 4 cc. or 20,000 units given intravenously every 3 hours was recommended, to be continued day and night until the temperature remained normal for 2 days.

On the 23d there was free pus discharge from the left nostril and the temperature fell to 102.6° F. The following day the patient began to take fluids by mouth and was less stuporous. By the 25th the frontal edema was diminished but there developed several convulsive seizures of short duration and a transient weakness of the right arm and leg. Two days later the frontal edema entirely disappeared and the soft spot in the scalp appeared less prominent. The temperature indicated a further decline by lysis.

On the 28th the orbital abscess was incised with release of considerable foul pus discharge and cultures taken revealed pure Staphylococcus aureus.

On 3 November after 12 days of penicillin therapy, the temperature became normal and the patient appeared well on the road to an uncomplicated recovery. On 5 November, when the drug was discontinued, the clinical picture had cleared except for residual swelling and ptosis of the left upper eyelid which gradually returned to normal. On 17 November the patient was up and about the ward, normal in all respects except for a slight lid ptosis and some limitation of motion on external and upward rotation of the left eye. This has now disappeared and the patient has been discharged as cured.

COMMENT

The case presented would appear typical of certain acute fulminant paranasal sinus infections characterized by high fever, pain and tenderness, spreading edema and poor sinus drainage that are notoriously prone to give rise to a sequence of dangerous intracranial complications, such as meningitis, extradural abscess, osteomyelitis and subdural abscess. Inadequate barriers of extension to the meningeal and extradural spaces predispose to a rapid spread to those particular areas. Extension to the cavernous sinus is also an established possibility. Staphylococcus aureus is the organism most commonly found in such cases.

CONCLUSIONS

1. It is our impression that the use of penicillin therapy was responsible for this patient's recovery and the shortening of his clinical course.

2. We are further of the opinion that certain dangerous intracranial complications previously characteristic of these infections have been avoided by such treatment.

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POSTVACCINAL (YELLOW FEVER) JAUNDICE

REPORT OF A FATAL CASE

JAMES ARNOLD DEVEER
Commander (MC) U. S. N. R.
and
MILTON J. MATZNER
Commander (MC) U. S. N. R.

In the Spring of 1942 there occurred a sudden outbreak of jaundice among Army personnel at widely separated posts, both within the continental United States and overseas. This increased incidence attracted considerable attention because of a suspected relationship of the jaundice to an icterogenic agent or agents in the vaccine employed in immunizations against yellow fever.

The clinical course of this disease was strikingly uniform in the great majority of instances. It resembled most closely the so-called "catarrhal jaundice" or "acute infective jaundice" of unknown etiology. Generally the cases were mild but in a smaller yet considerable number the disease was more severe. The approximate mortality was 0.2 percent. In the fatal cases the clinical course resembled and the pathologic material studied at the Army Medical Museum (*1*) demonstrated an acute or subacute yellow or red atrophy of the liver.

Coincidentally we also noticed an increased incidence of jaundice at a Naval hospital in the Spring of 1942. About 30 patients with jaundice were studied within a period of 2 months. All but one recovered and, with this exception, presented a clinical picture indistinguishable from the commonly termed "acute catarrhal" or "infective jaundice" of unknown etiology.

In this single fatal case there was a striking similarity both clinically and pathologically to the so-called postvaccinal (yellow fever) hepatitis or "acute yellow atrophy" observed in the Army. So far as can be ascertained no similar occurrence in the Navy has been reported.

CASE REPORT

A seaman, second class, 20 years of age, was admitted to the hospital with the complaint of anorexia, vomiting, jaundice, malaise, and abdominal discomfort of 18 days' duration. His past history was irrelevant. About 4 months prior to the onset of illness, the patient had been immunized with yellow fever vaccine. He

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had been in Russia for a short period the previous month and visited no other foreign ports or stations until his arrival in Iceland. While there his initial complaints were anorexia, vomiting, malaise, abdominal discomfort, and slight jaundice. During transit to the United States the jaundice deepened and the stools became intermittently clay-colored.

The patient was apathetic, acutely ill, and deeply jaundiced when admitted. The temperature was 99° F., respirations 18, pulse rate 72 per minute, and blood pressure 120/70. Neither the liver nor the spleen was palpable. There was slight deep tenderness in the right upper quadrant of the abdomen. Physical examination revealed no other pertinent abnormalities.

Results of a urinalysis were negative except for the presence of bile. Blood studies yielded the following results: Kahn test negative; icterus index, 75; prothrombin time, 75 seconds; prothrombin time after vitamin K injection, 80 seconds; total cholesterol, 200 mg. per 100 cc.; hemoglobin content, 13 gm.; erythrocytes, 3,810,000, and leukocytes, 9,450 per cu. mm., with a differential count of 5 bands, 55 segmented cells, 36 lymphocytes, 2 eosinophils, and 2 basophils.

A provisional diagnosis of acute infective jaundice was made.

The patient appeared to improve during the first few days of hospitalization under a regimen similar to that employed in other icteric patients. Essentially this consisted of a diet high in carbohydrates (300 gm.), high in proteins (175 gm.—less than 50 percent of this in the form of animal proteins) and low in fats (approximately 60 gm.). This diet was supplemented by thiamine, vitamin B complex, vitamin K, and bile salts. In addition, 2,000 cc. of 5-percent dextrose solution were administered intravenously for the initial 2 days and were then discontinued because of definite clinical improvement.

Up to this time the course of illness paralleled that observed in all the other jaundiced patients of our series. Then suddenly, without warning, the patient became very drowsy and unresponsive to questioning. The jaundice rapidly increased, the icterus index rising to 250. Dextrose infusions were again employed and the vitamin dosage increased. A suggestive decrease in the size of the liver to percussion and an "amine" or "fetor hepaticus" odor to the breath were noted. The temperature rose to 103° F. with a corresponding acceleration of the pulse rate. These findings prompted a revision of the admission diagnosis to acute yellow atrophy of the liver. There was no further response to treatment and the patient's condition became progressively more grave until he expired on the 18th day of hospitalization (the 26th day of illness).

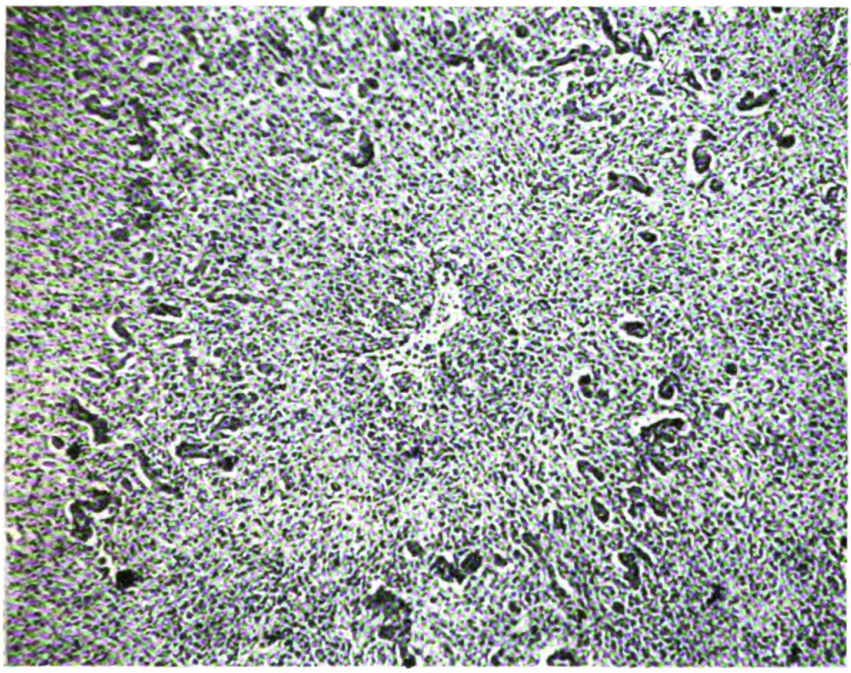
Autopsy findings.—The skin, sclerae, and most of the viscera were deeply jaundiced. There was rather widespread hemorrhage in and beneath the serous membranes of the thorax and abdomen with some blood tinging of the fluid in the serous cavities. The lungs contained numerous small and large hemorrhages. There were also scattered areas of bronchopneumonia in both lower lobes. The bronchi were filled with blood-tinged, frothy, mucopurulent exudate. The heart was of normal size. There were many small subepicardial hemorrhages but no other abnormalities.

Mucosal hemorrhages were found in the esophagus and stomach and at varying intervals throughout the intestinal tract. The kidneys showed bile staining of the cortex and there were petechial hemorrhages in the lining of the renal pelves. Ureters, bladder, prostate, adrenals, and pancreas were normal except as they shared in the generalized icterus.

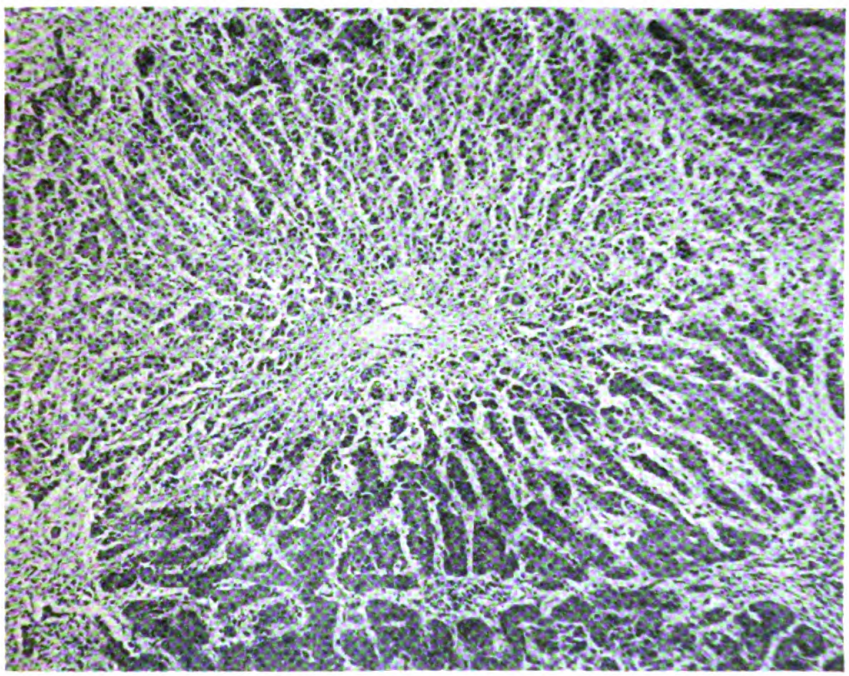
The most significant changes were found in the liver, which weighed 1,300 gm. The left lobe was extremely small and thin, with a reddish, wrinkled capsule and sharp margins. The right lobe was studded at irregular intervals with nodular yellowish and greenish patches while the intervening capsular surface

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was depressed, wrinkled, and red like that of the left lobe. The appearance of both the surface and cross section was characteristic of acute yellow atrophy



1. Liver from an area of "red atrophy" showing almost complete absence of parenchyma with retention of lobular stromal architecture. At the periphery of the lobule, bile ducts show evidence of proliferation.



2. A regenerated lobule showing radial arrangement of cords about an original central vein.

in a stage at which advanced necrosis and areas of regeneration are present. The yellow-green, nodular patches represented regenerated liver tissue, and the red-brown zones indicated more or less complete destruction of parenchyma with

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a squeezing in or collapse of the stromal framework. There was no dilatation of intra- or extra-hepatic biliary ducts. The gallbladder was not unusual.

Microscopic examination in general confirmed the interpretation of the gross appearance. Only in the liver were there any features of sufficient interest to warrant description. There was almost complete disappearance of liver cells in the areas of "red atrophy," but liver lobules could be recognized by the position of bile ducts at their periphery, and central veins were easily identified (fig. 1). Leukocytes of various types were scattered through the stroma and there were many hemorrhagic areas. Where parenchymatous cells could still be distinguished there was no striking degree of fatty metamorphosis. No intranuclear inclusion bodies could be found in Giemsa-stained sections. Where regeneration had taken place, that is, in areas that were grossly yellowish or green, there was often fairly close reproduction of the original lobular architecture, with cords radially arranged about a central vein (fig. 2). In some sites necrosis of the regenerated liver cells could also be found.

COMMENT

The microscopic findings in the liver differ from those in cases of yellow atrophy following poisoning by cinchophen, trinitrophenol, arsphenamine and other known causative agents, only in that regeneration is along more nearly normal architectural lines. One might conjecture, however, that in less severe cases of this type the patients will be found after recovery to have coarsely scarred livers studded with large nodules of regenerated liver tissue—the condition that has been described as "coarsely nodular regenerative cirrhosis" or "cirrhosis following subacute yellow atrophy." It would be of great interest to attempt to correlate a future case of "coarsely nodular cirrhosis" with a history of postvaccinal (yellow fever) jaundice occurring during the epidemic period of 1942.

The clinical course in this case at first appeared to be identical with that of other cases of acute infective jaundice observed by us during this period. Characteristically there was a gradual onset with initial gastro-intestinal symptoms of nausea, vomiting, intermittent diarrhea, abdominal discomfort, and slow pulse, with little or no fever. After a few days the gastro-intestinal symptoms gradually disappeared, the urine became dark, the stools pale, and the skin and conjunctivae jaundiced.

At variance with the usual clinical course was an initial period of 36 hours after admission in which the patient appeared more acutely ill, apathetic, and toxic than is usually seen. However there was an immediate favorable change after intensive therapy. Then without warning, and contrary to our usual experience, there was a sudden relapse and the patient expired 8 days after admission, the 26th day of illness. At autopsy there was noted an acute yellow atrophy of the liver in a stage when both advanced necrosis and regeneration were present, a picture apparently identical in type with that reported in the recent outbreak of jaundice in the Army.

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Such a sudden acceleration in tempo with fatal outcome in this type of hepatic disease is fortunately rare and has been reported to have an incidence of less than 0.2 percent. This case might have passed without much additional comment, possibly being regarded as an unusual complication of "acute catarrhal jaundice," had it not occurred when an increased incidence of jaundice with some fatalities at widely scattered Army posts had given rise to considerable concern and a good deal of speculation (*2*) regarding its possible relation to the administration of certain lots of yellow fever vaccine. Many of the Naval personnel, including this patient, had also been immunized with yellow fever vaccine in recent months, with some coincidental increase of admissions with jaundice.

An investigation by the War Department disclosed that the interval between the date of yellow fever vaccination and the onset of the disease varied from 40 to 120 days, with a few cases occurring as much as 6 months after vaccination. By checking on the numbers of the batches of vaccine, it was discovered that the jaundice was associated with the use of certain batches only. The Navy had received very little of this "icterogenic vaccine."

Among pertinent communications regarding this subject was a circular letter issued by the War Department (*1*) in which it was stated that epidemiologic considerations, particularly the essentially simultaneous appearance of the disease in a number of places, make it unlikely that it is the entity usually diagnosed as epidemic catarrhal jaundice. Because of a possible but still unproved relation to the administration of certain lots of yellow fever vaccine, all outstanding supplies of this material were recalled and a change made in the source of supply until completion of the investigation. In a subsequent report from the War Department (*2*) it was concluded that "it is not Weil's disease or any type of leptospiral infection. It is not a bacterial infection and has no relation to infectious mononucleosis. The disease is not yellow fever nor a modified form of yellow fever."

It was felt that the outbreak was a type of jaundice which followed the administration of certain lots of yellow fever vaccine. It was suspected that some icterogenic agent or agents were present in the human serum component employed in the preparation of this vaccine. Since then the vaccine has been prepared without the human serum component and it is believed the risk of jaundice has been eliminated.

Similar observations, that jaundice may follow the injection of human whole blood, plasma, or serum, either alone or incorporated in vaccines, have been reported. Several previous outbreaks of hepatitis and jaundice have been ascribed to yellow fever vaccination with vaccines containing serum (*3*) (*4*) (*5*). Beeson (*6*) recently reported the occurrence of jaundice 1 to 4 months after transfusion of

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whole blood or plasma. Propert (7) also called attention to the danger inherent in the use of convalescent serum. He recorded the occurrence of jaundice in an institution where a group of 7 children developed jaundice following administration of measles convalescent serum (from the same batch). Jaundice appeared after intervals varying from 78 to 83 days and in its earlier stages was indistinguishable from acute infective hepatitis. Three of the children subsequently developed rapidly increasing signs of liver failure terminating in death. At autopsy an acute yellow atrophy of the liver was found.

Whether the case here reported was an instance of "acute infective jaundice" with a fatal termination, or whether the acute yellow atrophy of the liver resulted from a more severe type of postvaccinal hepatitis comparable to that recently experienced in the Army is speculative, although the clinical and necropsy findings strongly suggest the latter possibility. Clinically the relationship of the jaundice to yellow fever immunization is possible. The interval of 4 months between the time of vaccination and the development of jaundice is well below the maximum reported interval of 6 months. The necropsy findings in the liver both grossly and microscopically were indistinguishable from those reported in cases of acute yellow atrophy ascribed by the War Department to postvaccinal (yellow fever) hepatitis.

A review of all cases of jaundice in the Navy occurring during the spring and summer of 1942, with particular attention to the vaccine lot number and the time interval after yellow fever vaccinations, might further aid in the elucidation of the possible relationship of this reported fatality to an "icterogenic vaccine."

It appears that the elimination of the human serum component formerly employed in the preparation of yellow fever vaccine has removed the risk of jaundice. It is of interest that an outbreak of jaundice of obscure origin was reported (8) from a U. S. Naval base hospital in the South Pacific. A total of 320 patients with jaundice were treated without fatality in a one-year period with a peak incidence in the first 6 months of 1943. There was no evidence that that outbreak was related to previous inoculation against yellow fever. However, in the event of a future outbreak of jaundice, it is suggested that any relationship to the administration of yellow fever vaccine, whole blood, or plasma or other related biologic products, be investigated from the standpoint of the possible presence of an icterogenic agent or agents.

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SUMMARY AND CONCLUSIONS

1. The probable relationship of jaundice to yellow fever immunization by vaccine containing human serum is reviewed.

2. A fatal case of acute yellow atrophy of the liver is reported and a possible relationship to previous yellow fever immunization suggested.

3. A fatality occurring in the Navy ascribable to inoculation against yellow fever has not previously been reported.

4. The risk of postvaccinal (yellow fever) jaundice appears to have been removed by the elimination of the human serum component formerly employed in the preparation of yellow fever vaccine.

5. In the event of any future outbreak of jaundice it is recommended that any possible relationship to the administration of yellow fever vaccine, whole blood, plasma, or related biologic products be investigated in the hope of discovering the presence of some as yet unrecognizable icterogenic agent.

6. While it is likely that in the milder instances of postvaccinal jaundice with recovery the liver was damaged to a much slighter degree than in the case here reported, one might speculate that the amount of destruction and regeneration varied widely. Opportunities to observe the late anatomic results of these processes in the liver in nonfatal cases may, in time, be presented.

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SURGICAL TREATMENT OF SEVERE MUMPS ORCHITIS

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In military service there is opportunity to observe large numbers of cases of mumps, and the complications encountered are more numerous and varied than those seen in civil life. This report deals with severe orchitis in mumps and its surgical treatment.

Only the exceptional cases of testicular involvement are treated surgically, the proportion being but a small fraction of the total number of patients with this complication. The indications for surgical decompression of the testicular capsule are extreme swelling and tenderness of the testicle with severe pain, high temperature, prostration, headache, and nausea. There may or may not be involvement of other organs, such as the brain or the pancreas. The most important indication is extreme testicular swelling.

Wesselhoeft and Vose [1] state that the resistance of the tunica albuginea appears to be responsible for the severe pain and the pressure necrosis that leads to subsequent testicular atrophy. They stress the importance of early operation, immediately upon the appearance of severe swelling, on the theory that if the pressure is permitted to exist too long, surgical intervention will not prevent later atrophy.

The extreme tenderness of the scrotum precludes the use of local or intravenous anesthesia in these operations. In this series spinal anesthesia was used; Wesselhoeft and Vose advocate gas-oxygen. Small doses of a spinal anesthetic which was effective at a high enough level to obliterate pain referred upward by manipulation of the exquisitely tender testis were used in our cases.

A 1-inch incision is made through the scrotum over the upper pole of the testicle. A copious quantity of straw-colored fluid usually escapes as the tunica vaginalis is incised. This may or may not be under tension, depending upon the amount. A nick ¼- to ½-inch long is then made through the tunica albuginea over the upper pole of the testis; a similar incision is made at right angles to and joining the first. There will be slight bleeding. The testicular substance

[1] WESSELHOEFT, C., and VOSE, S. N.: Surgical treatment of severe orchitis in mumps. New England J. Med. 227: 277–280, August 20, 1942.

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will not herniate to any great extent. A small piece of rubber tissue is left in place and the scrotal incision is loosely closed with a single suture.

Within 24 hours following operation the testicular tenderness usually subsides; the amount of drainage is small and the drain is removed approximately 48 hours postoperatively. The testicle has, by then, visibly decreased in size and usually returns to normal size within 7 to 14 days. Sensitiveness of varying degree will persist for a few days to several months. Atrophy occurs only rarely and usually is not total.

Clinically the striking features of the response to decompression are the rapid drop in temperature and the quick relief from pain. The subjective improvement is remarkable. The chief purpose of the operation is the release of pressure and the prevention of necrosis and subsequent atrophy. Even though atrophy may at times occur it is believed that the operation is still worth while for the symptomatic relief it affords.

Prior to operation the patient is febrile, toxic, nauseated, and complaining bitterly of headache; any slight movement accentuates pain in the enormously swollen testicle and scrotum; palpation of the testicle is resisted and arouses loud protest from the previously lethargic, frequently somnolent patient. Within 24 hours after operation the patient is taking food, feels much better, the temperature has returned almost to normal and tenderness of the testis is markedly decreased.

CASE REPORTS

Case 1.—A seaman, second class, 21 years old, was admitted to this hospital with a diagnosis of mumps with involvement of the right parotid gland. The following day there were marked nasal and pharyngeal congestion, a profuse mucopurulent postnasal discharge, foul breath, marked enlargement of the cervical nodes and general dehydration. His maximum temperature was 102° F. Several days later he complained of severe frontal headache and the temperature range was 102° to 103° F. Three days later the right testicle swelled to almost three times its normal size and was very tender. The severe headache persisted; the temperature hovered around 103° F. The next day the testicle was decompressed. The temperature returned to normal on the second postoperative day.

Postoperatively the severe headache continued and the patient was semicomatose and was vomiting. A moderate degree of papillitis was seen on ophthalmoscopic examination. On the day following operation the spinal fluid showed 48 cells per cubic millimeter, there was an increase in globulin, but no organisms were demonstrable by Gram's stain. A diagnosis of mumps encephalitis was made and the patient was given intravenous fluids because of continued vomiting. Three days later he was less lethargic, the nausea had disappeared, and the temperature was normal. Two days later he was taking fluids and ice cream. He was returned to full duty 24 days after operation. The testicle had returned to normal size and became nontender within 14 days of operation. At the time of discharge there was no atrophy.

Case 2.—A machinist's mate, second class, 24 years of age, was admitted to the hospital with a diagnosis of bilateral submaxillary mumps. The temperature

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range was 101° to 102° F. The left parotid gland was swollen. On the third day the patient became afebrile but on the fourth day there was a sudden rise in temperature accompanied by chills and pain in the right testicle. The testicle became inflamed, tender and enlarged. Testicular swelling increased and 2 days later a right orchotomy was performed. There was a gradual return of temperature to normal, and on the fifth postoperative day the testicular tenderness had disappeared. The testicle was of normal size and nontender 6 days after operation and the patient was returned to full duty 3 weeks after operation. On discharge no atrophy was observed.

Case 3.—An electrician's mate, third class, 30 years old, was admitted to the hospital with bilateral parotid swelling. His temperature was normal until 3 days after admission when it suddenly became elevated to 103.4° F. The patient complained of generalized aching; there was marked bilateral swelling of both parotid glands and the right testicle began to swell, becoming extremely tender, hot and tense. Two days later the testicle was estimated to be three times normal size and a right orchotomy was performed with dramatic relief of pain and a remarkable drop in temperature.

On the second postoperative day the left testicle became swollen and tender and there was a moderate rise in temperature. A left orchotomy was performed and the temperature dropped to 99.4° F. the following day. Four days later however the patient complained of generalized aching, sore throat, generalized abdominal pain, headache and vomiting. The abdomen was distended but nontender. The left parotid gland had diminished in size but the right was slightly swollen and tender. The left testicle was moderately enlarged and quite tender; the left cord was thickened. By the next day the patient felt much better; his abdomen was soft.

Three weeks later parotid swelling had disappeared but slight enlargement and distinct tenderness persisted in each testicle; 10 days later most of the swelling had disappeared but the tenderness continued. Five weeks later he was returned to duty. Throughout his convalescence he exhibited a diurnal temperature variation of 1 degree. At the time of his return to duty both testicles were slightly tender; the right was estimated to be one-half normal size, the left showed minimal atrophy.

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POSITION IN SHOCK

The shock patient should be placed in bed in the horizontal position, without elevation of the foot of the bed. The Trendelenburg position has not proved its value clinically. Experimentally it has been shown that the pooling of blood in the capillary reservoir, as occurs in shock, is not effected by gravitational forces. For the treatment of primary or initial shock which occurs immediately following trauma the Trendelenburg position is indicated and of value.—SEGAL, M. S., and AISNER, M.: Management of certain aspects of gas poisoning with particular reference to shock and pulmonary complications. Ann. Int. Med. **20** (o. s. 25): 219–227, February 1944.

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TANTALUM IN REPAIR OF EXTENSIVE INJURY OF THE FOREARM

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The recent employment of tantalum in the field of surgery is deserving of further study. At the present time clinical reports are few because the supply of this metal is very limited. Tantalum is a bluish-gray metal having many of the physical properties of steel. It is the 73d element of the periodic series, occurs in group 5, and has an atomic weight of 181.4. Tantalum has a great affinity for oxygen. It can be rolled into sheets and foil and drawn into fine wires of varying thickness. The sheets and foil can be molded and cut to the desired shape and size, whereas the fine wire has a tensile strength comparable to mild steel.

Burke (*1*) in 1940 was the first to employ tantalum, while testing the corrosive action of metals in tissues. Since that time this metal has found surgical use as bone screws, bone plates, hemostatic clips, ribbon strips, and sutures. Pudenz and Odom (*2*) in 1942 embedded strips of tantalum ribbon in cerebral tissue without provoking an inflammatory reaction. Several months later Pudenz reported that there was minimal encapsulation by fibroblasts and neuroglia fibrils with the use of tantalum clips for hemostasis on meninges or neural tissues (*3*). Fulcher (*4*) obtained an excellent clinical result following the repair of a frontal cranial defect 3 cm. by 4 cm. using tantalum foil 25 mills in thickness. Venable and Stuck (*5*), after making a detailed study of metals for buried appliances in surgery, state that tantalum wire is inert in any body fluid and therefore most ideally suited for surgical application.

So far as can be ascertained, no report of tendon or peripheral nerve repair with the use of tantalum has been published. In the following case tantalum wire and foil were used with gratifying results in the repair of a severe laceration of almost all the flexor tendons of the forearm and the ulnar nerve.

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CASE REPORT

An 18-year-old apprentice seaman was admitted to the hospital with the diagnosis of wounds, multiple, and lacerations of the right shoulder and forearm incurred in a crash through a glass door. The patient was in shock. Examination showed a laceration 15 cm. long over the right deltoid and a V-shaped



1. Roentgenogram showing fine tantalum sutures and tantalum foil with wrist in flexion.

laceration over the lower volar aspect of the right forearm, which had severed the ulnar artery. Ability to flex the 3d, 4th, and 5th fingers of the right hand was lost and there was anesthesia in the ulnar distribution of this hand. The physical and neurologic examination yielded no other pertinent findings.

Sulfanilamide powder was dusted into the wounds, pressure bandages were

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applied, and the patient was given a transfusion of 500 cc. of whole blood. About 6 hours after injury the patient's general condition had improved sufficiently for surgical intervention. Under general anesthesia the ragged wound over the deltoid region was debrided and closed without drainage. The V-shaped wound of the right forearm was enlarged and careful exploration revealed complete



2. Roentgenogram with wrist extended. Note shift of the tantalum sutures and foil.

severance of the tendons of the palmaris longus, flexor digitorum sublimus, and flexor digitorum profundus, just distal to their muscle attachments. The ends of the ulnar nerve and the retracted end of the ulnar artery were readily seen in the exposed field.

The ragged edges and devitalized portions of the torn and exposed muscles were removed and the corresponding severed ends of the tendons were identified

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and sutured with fine tantalum surgical wire, size 0.003. The cut ends of the ulnar nerve were then joined end-to-end, using 6 interrupted sutures of tantalum wire of the same thickness. A small cuff of tantalum foil was placed around the line of nerve suture. The wound was then dusted with sulfanilamide powder and closed without drainage. Almost 4 hours were required to complete this operation.

The flexed position of the wrist was maintained by the application of a posterior plaster splint. Active motion of the fingers was encouraged after the third postoperative day. On the fifth postoperative day the posterior splint was temporarily removed and x-rays of the forearm were taken first with the wrist flexed (fig. 1) and then extended (fig. 2). By measurement the tantalum wire sutures as seen in the x-rays showed an excursion of 5 mm. Motion of the fingers was encouraged daily while the splint was temporarily removed. The splint was totally discarded on the twenty-first postoperative day and physiotherapy instituted.

Seven weeks after injury the patient was discharged to active duty. At this time the wound was well healed, the grip was powerful, there was no limitation of movement in any of the fingers, and there were no vasomotor disturbances. Anesthesia in the distribution of the ulnar nerve remained unchanged.

It is felt that the reaction to tantalum wire and tantalum foil was particularly favorable in this case, demonstrating that the tensile strength of this wire permitted early active motion with a minimum of tissue reaction. This suture material has the further advantage of being radiopaque and therefore its active function can be determined by comparative x-ray studies. Tantalum wire is now available in finer sizes, which when attached to an atraumatic needle, is particularly suited for the suturing of very delicate muscle strands and nerve fibers. It is believed that tantalum foil, acting as a cuff around the line of nerve suture, will greatly reduce the incidence of neuroma, and if such a neuroma should form, a comparative x-ray study would readily reveal its presence. Since this case was reported we have used tantalum wire in more than 50 cases of nerve and tendon injuries with satisfactory results.

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ICAL CURE OF VOLUMINOUS VENTRAL HERNIA

CASE REPORT

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ases of large ventral hernias there is usually a history of a
is operation wherein the nerve supply to the abdominal wall
n injured or improper healing of muscle or fascia has occurred.
tient usually first observes a small swelling at the site of the scar
gradually develops into a large hernial mass. Meanwhile over
period of time there is an anatomic and physiologic adjustment
arge hernia and symptoms sufficient to force the patient to seek
l intervention are not experienced.

ors influencing successful repair of these large hernias include:

Weight of the patient.
Size of the hernial sac.
Contents of the sac.
Adjustment of abdominal area.
Muscle and fascia integrity.
The suture material.

surgeon must also consider the shock involved from changes
a-abdominal and intrathoracic pressure when a great mass of
m and intestines is replaced into the abdomen. A lifesaving
n the postoperative treatment and a prophylaxis against ileus
routine insertion of a Levine duodenal tube before surgery,
ing it to remain in place for at least 3 days postoperatively.
pression of the patient in this manner is an aid in preventing
ia as well as ileus, and greatly decreases the tension on sutures.
e preparation of the obese patient for herniorrhaphy is very
ant. He is admitted to the hospital for a 24-hour rest period
which the liver glycogen reserve is built up and thorough
tion is obtaind by multiple enemas. The abdomen is treated
24-hour surgical preparation of tincture of merthiolate which
sealed with a large sterile surgical dressing. Just preceding
the entire abdomen is again painted with tincture of merthio-
ich is allowed to dry thoroughly before draping. All incisions
gically sealed after the operation and are left unmolested for

All abdominal layers should be dissected widely and radically. Intestinal and omental adhesions should be carefully separated from the anterolateral abdominal wall. Generally speaking the large fat-adherent omentum should be rather radically resected. Thorough hemostasis and rigid asepsis is the rule After the abdominal layers have been carefully dissected so that the cut margins approximate without too great tension, the peritoneum is closed with running chromic No. 1 catgut sutures. Silver wire through-and-through mattress sutures incorporate fascia and muscle.

At times it is necessary to include the entire abdominal wall, peritoneum, muscle, and fascia with the through-and-through wire sutures. This can be done safely if the walls can be brought together in complete apposition at the time the wire suture is tied. The free edges of fascia are approximated with a running chromic No. 2 suture and then rolled up laterally to attach firmly into the fascia. Rolling up the free edges of fascia after first wiring the opposed walls together with carefully placed mattress, heavy piano-wire sutures tends further to strengthen the suture line. Thus a firm, thick, ropelike fascia is obtained directly over a formerly weak area.

In certain selected cases of an enormous hernia in obese patients this procedure is preferable and makes for a stronger abdominal wall than the Cattell method of two suture layers. The latter is more simple and quick and should be used when time is a factor. Retention button sutures are also used with a No. 5 silk. The abdomen is sealed by strapping firmly with tape and the patient is treated expectantly with continuous decompression, intravenous fluids and oxygen inhalation.

In the case to be reported here there was no tissue reaction of any kind. The wound healed completely by primary intention even though 10 mattress heavy wire sutures were used in closing the wide hernial opening. The patient has been working at all classes of labor for 2 years since the operation and there has been no weakness of the operative scar.

CASE REPORT

The patient, a white man 37 years of age, was 5 feet, 5 inches tall and weighed 220 pounds. In 1930 he had had a ruptured appendix with peritonitis. Six months later he noticed a small swelling at the lower angle of the right rectus scar. This swelling gradually became larger until 1935 when he stated that the hernia was the size of a watermelon and it was necessary for him to "carry it around" with him. He could hear gurgling noises in the large mass, and whenever he would roll over in bed he would first have to lift the huge bulging mass.

Examination did not disclose any abnormalities other than the obesity and enormous ventral postoperative hernia which came through an opening in fascia over 8 inches in diameter. The entire hand could enter this opening and palpate the fascial margins of the defect.

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The patient's weight was reduced 25 pounds prior to operation, and he was advised concerning the chances for successful repair. At operation it was found that the hernial sac contained all of the small and most of the large bowel, a part of the stomach, and a huge fatty adherent omentum. A radical omental section was done and all fascia and muscle layers dissected as far as possible. All adhesions of bowel to the abdominal wall were severed.

The peritoneum was closed with chromic catgut sutures and the muscle

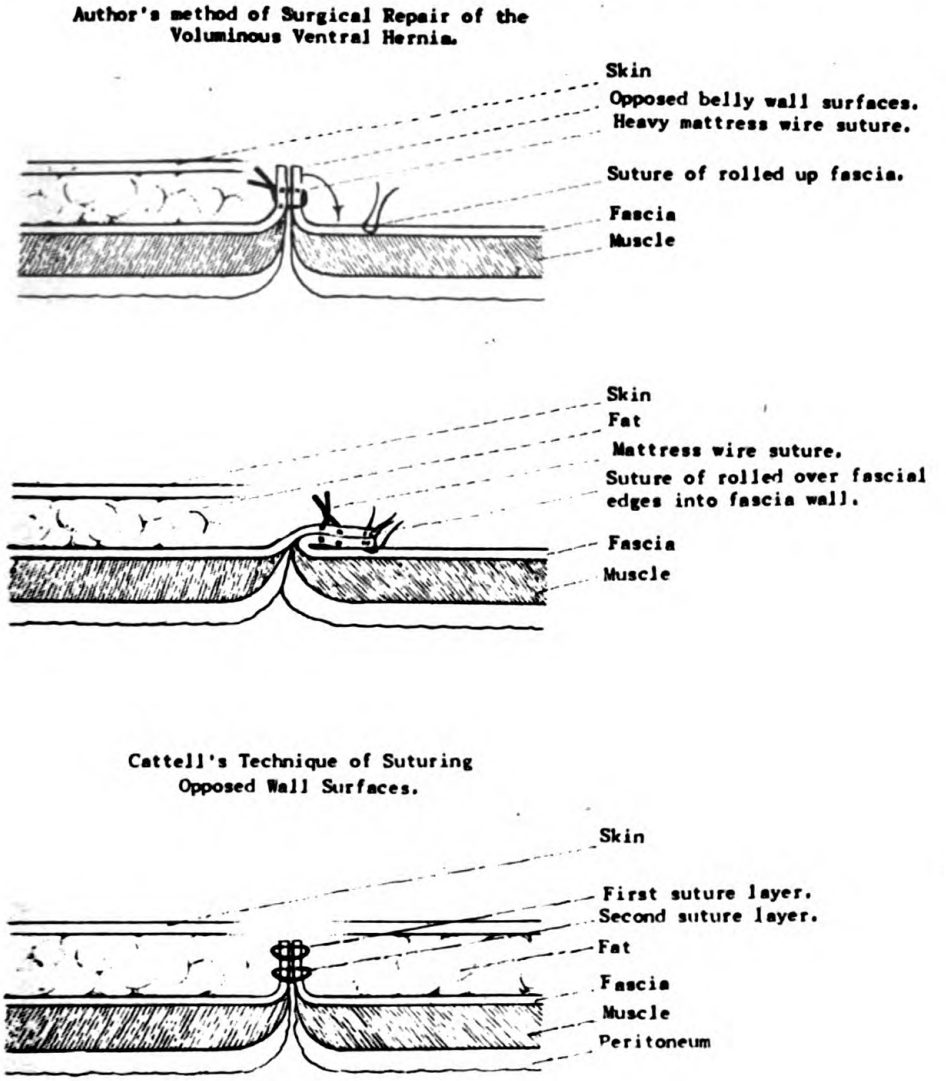


Figure 1.

and fascia layers were approximated with mattress heavy wire sutures, approximating surfaces rather than edges, after the technic of Cattell. The free opposing surfaces, approximately one-half inch of fascia with muscle, were now "rolled" laterally by running chromic No. 2 catgut suture into a firm fascial wall (fig. 1). As much as possible of the muscle tissue was sutured with the fascia. Chromic gut, silk and fine wire were used first in the fascia but the tension necessary to hold together the wall was such as quickly to break these sutures and it was necessary to resort to heavy wire.

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The patient remained in bed for 3 weeks following surgery. After a 3-day stormy postoperative period during which gastro-intestinal decompression, oxygen therapy, and intravenous fluids were all used, he made an uneventful recovery. The patient was passed as 1A by the United States Army but he

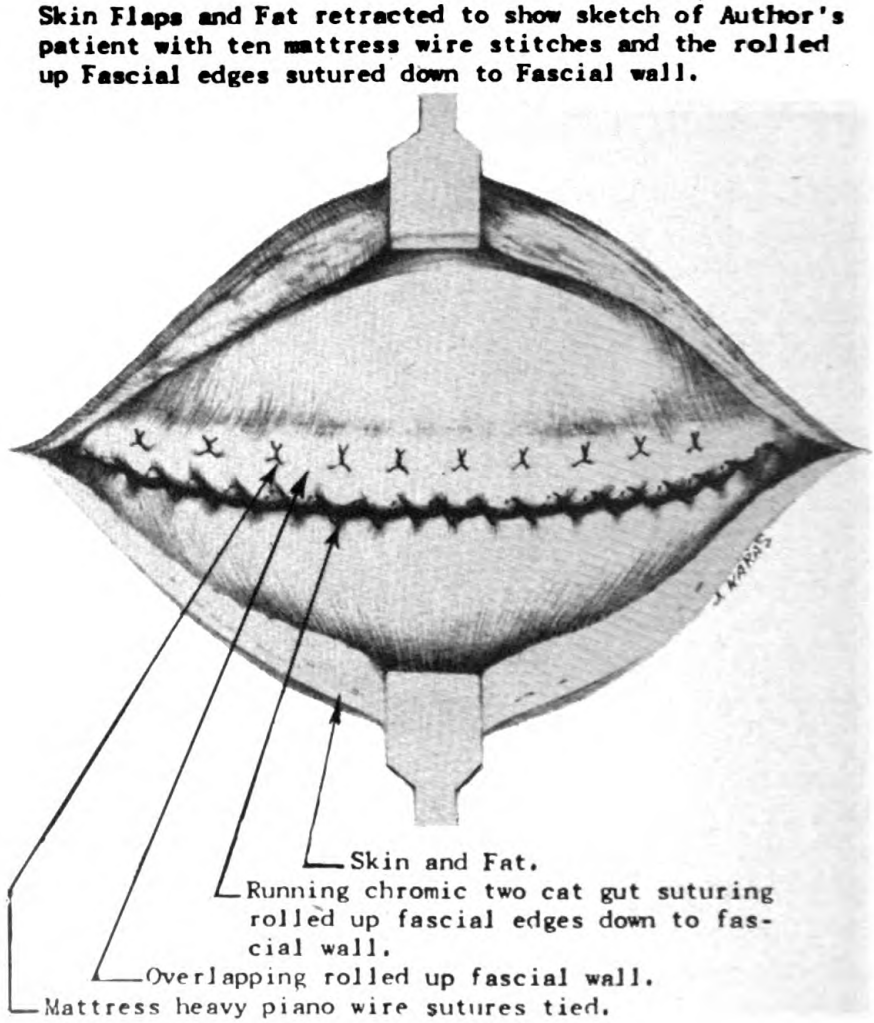


Figure 2.

insisted upon an x-ray examination of his abdomen, which showed a row of 10 mattress silver wire stitches in the abdominal wall. The examiner advised him that they could not pass anyone that full of "safety pins."

Examination 3 years after operation disclosed that the patient is well, strong, and has a very firm abdominal wall, the scar retaining its thick, cordlike consistency.

The operative repair of the voluminous ventral hernia is one of those few exceptions in major abdominal surgery in which complete fearlessness and confidence in radical procedures completely overshadow all wishful conservatism if a real cure is to be expected.

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TREATMENT OF VARICOCELE BY LIGATION AND INJECTION

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The radical surgical treatment of varicocele is a debatable subject and many surgeons feel that it is rarely indicated. No doubt the frequently unsatisfactory result of surgical excision has contributed to this attitude. In many cases the only treatment necessary is reassurance to the patient of the benign nature of the condition. There are, however, numbers of patients, particularly in military service, who complain of marked discomfort with pain and aching in the testicle, groin, and lower back, more often on the left side.

Immediate complications following excision, such as hematoma of the cord and marked swelling of the cord and testicles, even without hematoma formation, are fairly common. Occasionally infection of the hematoma occurs which is a serious complication. Late unfavorable sequelae are: (1) Failure to cure the condition completely; (2) hydrocele of the testicle; (3) atrophy of the testicle; (4) prolonged induration and swelling with disability.

The method herein described has been used in more than 30 cases. The exact number of patients treated cannot be ascertained, because some were treated while in private practice, others while on duty at a Naval hospital, and the last 15 aboard ship in foreign waters.

The method is reported because of the excellent immediate results in all cases and the excellent late results in cases examined at intervals ranging from four months to one year. There have been no immediate complications of any kind. In none of the patients treated thus far has there been any swelling of the testicle following the procedure. In many cases even the cord has been strikingly free from tenderness, and only rarely has a hypodermic injection been necessary for postoperative pain.

The principle of the treatment is exactly the same as for the treatment of varicose veins in the leg: By saphenous ligation and injection of sclerosing solution. For a varicocele a small incision is made slightly above and parallel to Poupart's ligament and just medial to the internal inguinal ring. The external oblique fascia is incised longitudinally and the cord exposed. It is not necessary to

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isolate the cord. The cremasteric muscle and fascia covering the cord is grasped with two Allis forceps and incised.

Immediately upon incising this muscular and fascial covering of the cord, two veins come into view, one larger and one smaller, lying in the loose areolar tissue of the cord. In some cases only the large vein comes into view, and no further search is made for the smaller vein. A segment of the veins is carefully isolated from the surrounding structures. Care should be exercised not to puncture or tear the thin-walled veins, as this immediately obscures the vessels and makes injection of the sclerosing solution more difficult and uncertain. In most cases a small artery is found along the upper border of the large vein and this should be carefully separated from the vein. The vas deferens lies at a deeper level and is not pulled into the wound with the veins.

The isolated veins are doubly clamped and severed between the clamps. The large distal vein only is then injected with 1 cc. of sodium morrhuate 5 percent. By exerting tension on the vein after the needle is inserted, some of the blood in the varicocele is forced out of the veins which makes the sclerosing solution more effective. The distal and proximal stumps held by the hemostats are first ligated separately and then approximated and secured by including both stumps in one ligature. The incision through the cremaster muscle and fascia is closed and the wound is closed in layers.

The operation is done under local anesthesia, and the patient may be allowed up the following day. Swelling of the testicle has not been observed in any of the cases thus far treated and it is rarely tender after the operation. The sclerosed veins can be palpated easily, are usually not tender, and can be freely moved over the other structures of the cord as the remainder of the cord is not indurated. The sclerosed veins are palpable as hard cords for a variable time, usually up to three months. In one case the hard cordlike veins were still palpable at the end of four months; however, with complete relief of the symptoms.

The normal function of contraction and relaxation in response to temperature changes is immediately restored to the scrotum. One patient has been under observation for one year. He has been completely relieved of his previous symptoms. Palpation of the cord reveals a cordlike structure so similar to the vas deferens that the latter can be identified only by its characteristic pain response to pressure.

The procedure is offered as a simple and rapidly effective method of treatment of a common condition among military personnel. The treatment has been used only in patients having marked subjective symptoms, and in no instance has it been recommended in cases discovered in routine physical examinations.

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MEDICAL AND SURGICAL DEVICES

A CLINICAL LABORATORY IN SOUTH PACIFIC AREA

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In the work of an advance base hospital, the clinical laboratory has assumed increasing importance as a vital part of the unit. This is especially true of those fighting fronts where the menace of tropical diseases throws as great a burden upon the laboratory as the actual battle casualties. At times the problems associated with malaria, dengue, acute infectious jaundice, filariasis and other tropical infections may completely overshadow the laboratory demands made by combat injuries. A carefully planned laboratory unit may do much to facilitate the handling of routine and emergency work.

There are many designs that the clinical laboratory for any given hospital unit may require, all utilizing certain standard types of equipment under varying conditions. The experiences gained in supervising the design of two such units for a Naval advance base hospital may, however, prove useful to future units. Owing to the necessity of beginning immediate operations to care for large numbers of combat casualties soon after arriving at our destination, the original laboratory contained several defects which were eliminated in the construction of the second unit.

Each laboratory was housed in a single standard type Quonset or Stran-steel hut, but the second unit contained 32 square feet more floor space than the original. Through judicious use of space it has proved quite practical to operate a clinical laboratory, necessary to service a 1,000-bed hospital, within a standard Stran-steel hut with a floor space 20 by 44 feet.

From experience it was found that a cement deck is more satisfactory than the standard wooden decking supplied, since it gives greater stability. In the original wooden floor unit it was sometimes difficult to focus properly a high-dry or oil-immersion microscope field when personnel were moving about inside the building.

Cross ventilation obtained through adequate window space is important for general comfort in tropical areas, even though both ends

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of the hut are completely open except for screening. The heat generated through the operation of the various pieces of equipment within an insulated hut cannot be properly dissipated without open ventilation.

Another important consideration is the incorporation of a small, but completely closed bacteriology room in one corner of the laboratory. By eliminating air currents through this room the contamination of bacteriologic media by molds and other air-borne organisms can be reduced.

Figure 1 shows the floor plan of the present laboratory, and figure 2 gives a general view of the working area, exclusive of the forward 8 feet of floor space. This first 8 feet of space is utilized for desks and for a patients'-waiting area. A wooden barrier 3 ft. 6 in. high, with gates separates this waiting-room space from the general working area without interfering with ventilation.

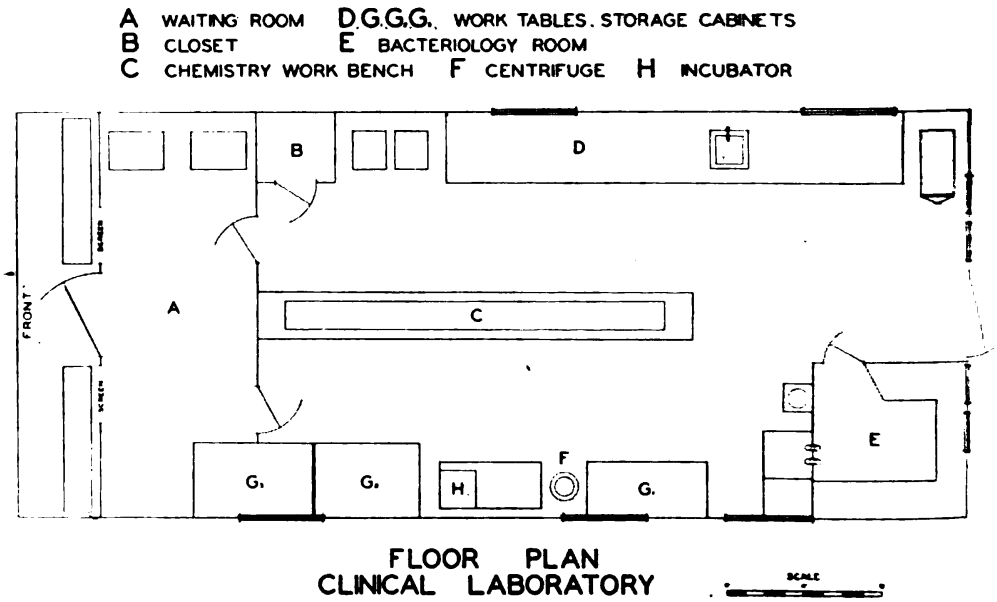
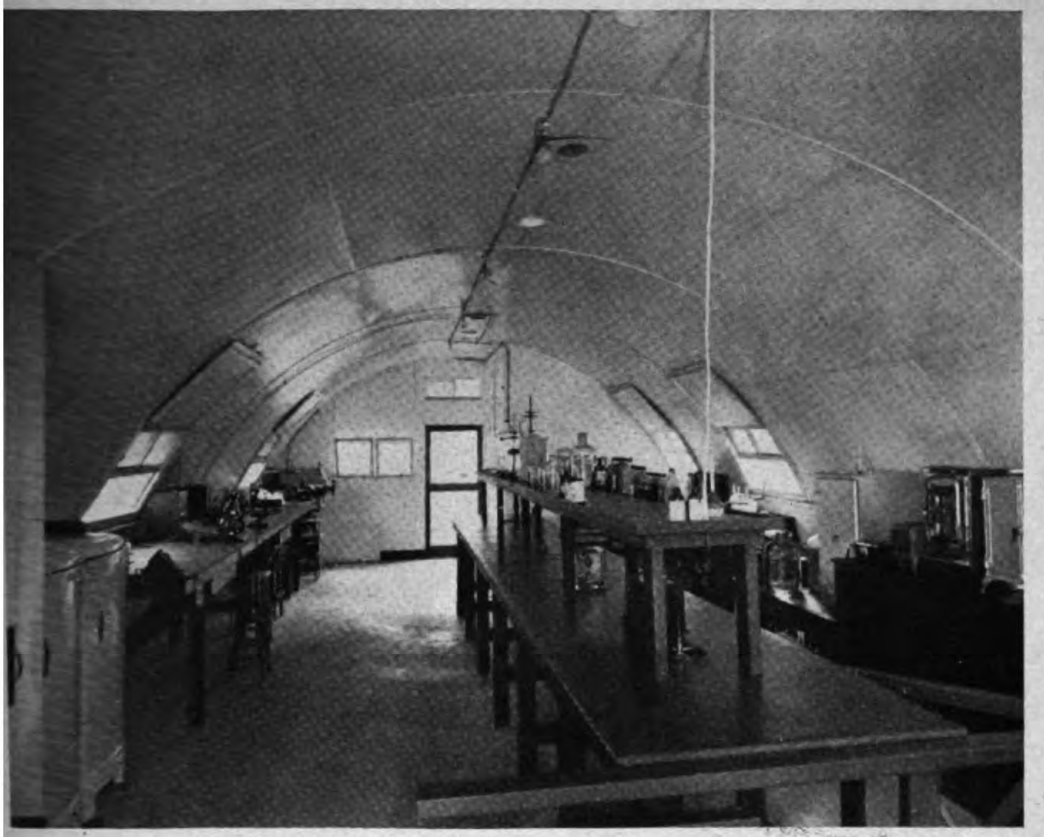


Figure 1.

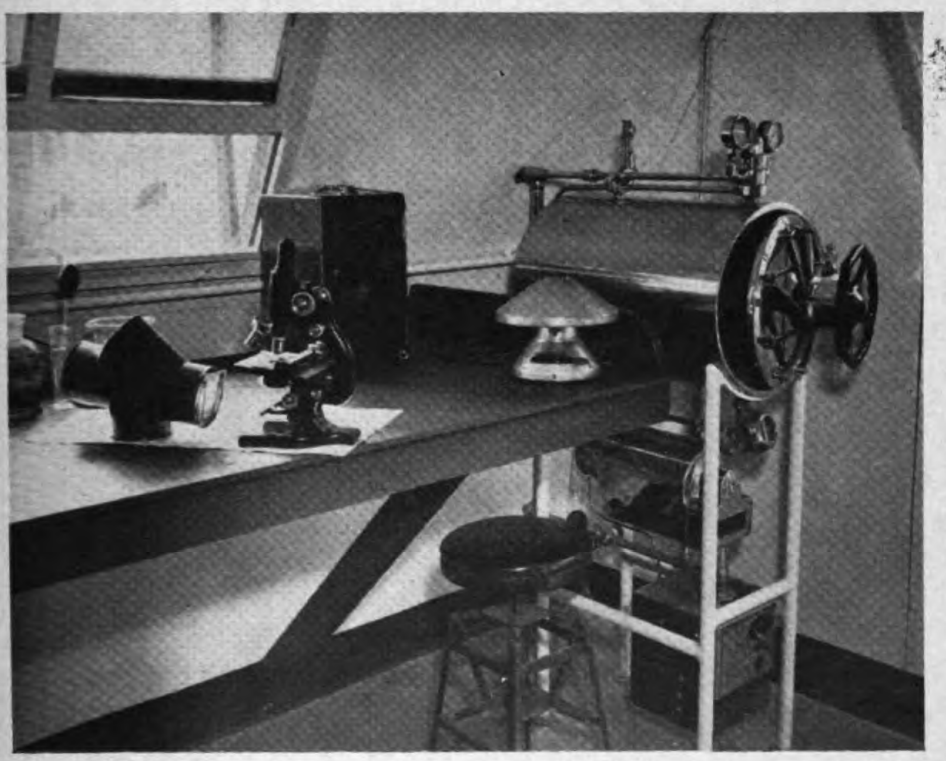
An enclosed coat closet also provides shelves for reference books as well as space for an alcohol and poison locker. A 50-watt bulb continuously burning within this closet keeps the space relatively moisture free so that book bindings do not mold as rapidly as if constantly exposed to an atmosphere of high humidity.

The hematology and urinalysis bench along one side of the working space contains a shallow sink and water tap. A staining rack constructed of 3/8-inch welding rods provides ample area for staining slides. Figure 3 shows the electrically operated autoclave which occupies the corner of the room at the end of the urinalysis bench.

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2. General view of working area of laboratory.



3. Autoclave at end of urinalysis bench.

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Eight square feet of the deck of the opposite side of the after end of the laboratory are taken by the enclosed bacteriology room. A workbench along two sides of this room, and shelving along a third bulkhead gives adequate working space for bacteriology and tissue sectioning, as well as serving for a general reagent and media storeroom. Figure 4 shows a portion of this room.

The area just forward of the bacteriology room is shown in figure 5. This space is occupied by a deep galvanized iron sink with attached drainboard. An electrically operated Barnstead still is hung on the bulkhead next to the sink at sufficient height so that the overflow is led directly into the sink. This gives an excellent source



4. Portion of bacteriology and tissue sectioning room.

of hot water whenever the still is in operation. With a capacity to produce approximately 1 gallon of distilled water per hour, this still provides ample water for the hospital laboratory and pharmacy as well as several dispensary units located in the area.

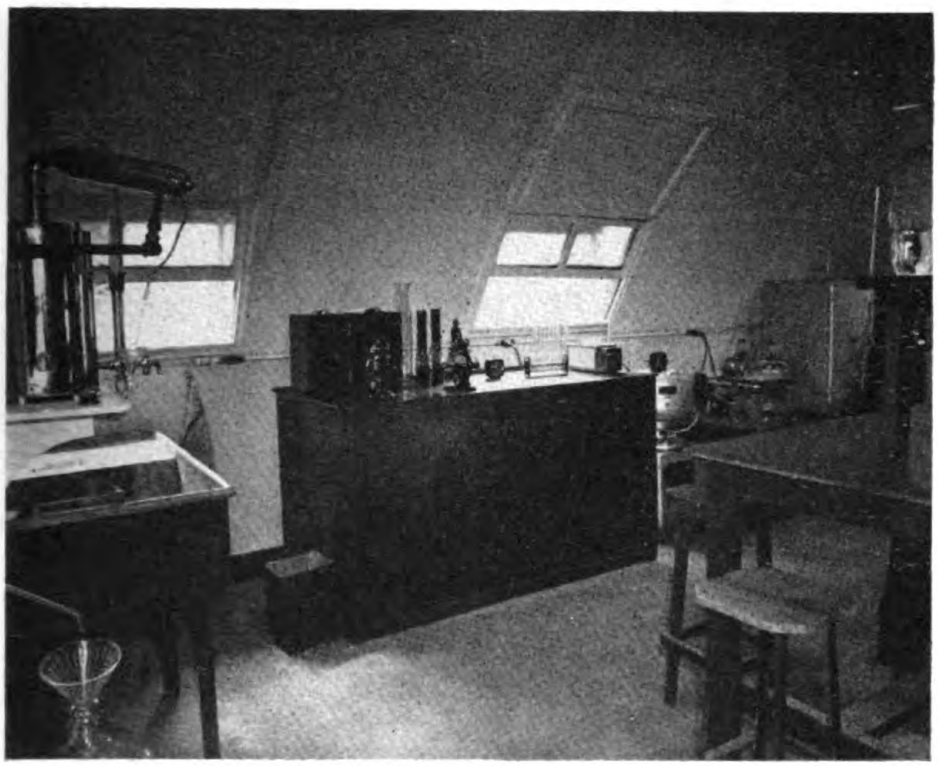
The remaining wall space of the working area is occupied by combination workbench and storage cabinet units built of 5/8-inch plywood. These are utilized for serology, tissue dehydration and embedding, large centrifuge, Kahn shaker, incubator, and dry heat sterilizer. The forward end of the last cabinet, being adjacent to the patient-waiting area, contains an electric boiling water sterilizer and the necessary syringes, needles, test tubes and pipettes for obtaining blood specimens, etc., from ambulatory patients.

A double-decked table through the center of the working area provides adequate space for blood chemistry determinations, with the necessary reagents easily accessible on the top shelf. Three Bunsen burners operated from acetylene gas are located on this center

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bench. Two burners are also located on the hematology and urinalysis workbench; a single burner is adequate in the bacteriology room.

Slight modification of the ordinary illuminating gas burner is necessary before it will give a satisfactory flame with acetylene. In this laboratory this was accomplished by partially occluding the jet aperture with a fine wire. The proper mixture of acetylene and air is thus obtained to give an excellent carbon free, blue cone flame. Tanks of acetylene for oxyacetylene welding, and a reduction valve are usually readily obtainable at any Naval activity, and are the source of gas used in this laboratory. For safety purposes, the



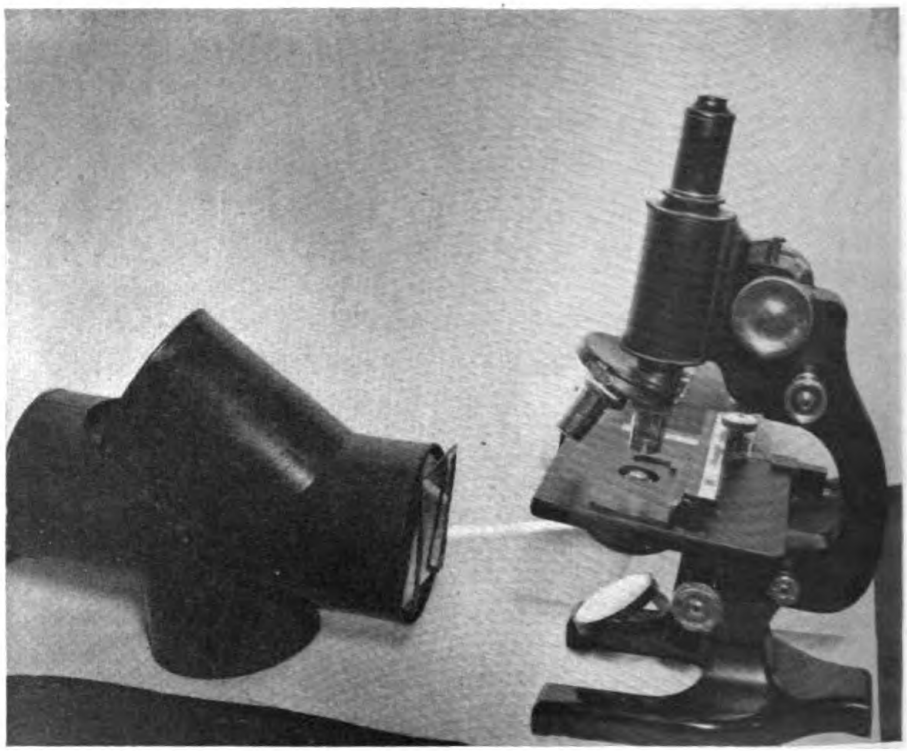
5. Area just forward of bacteriology room.

acetylene tank is housed in a separate closed space outside the main building. A quarter-inch pipe is used to lead the gas to the various outlets within the laboratory.

At an early date in the operation of this hospital unit it became necessary through press of work to obtain more microscope lamps than were available at the time. An extremely satisfactory light was constructed by our electrician from portions of ordinary tin cans fitted with a socket and a standard 100-watt bulb. These lights are sufficiently powerful to give excellent illumination for darkfield examinations. One of these lamps is illustrated in figure 6.

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The general illumination, as well as the appearance of the laboratory is improved by flat white paint on the bulkheads and overhead. Dark green is the color used on the workbench legs and cabinets, and for the swab-stripe extending 6 inches above the deck. The surfaces of the workbenches and cabinets on both sides of the working area are finished with an acid resisting compound, while the blood chemistry table and the workbench in the bacteriology room are covered with dark red battleship linoleum.



6. A simply constructed microscope lamp.

CONCLUSIONS

1. A satisfactory and adequate clinical laboratory for a base hospital of 1,000-bed capacity can be housed in a single building with 20 by 44 feet of floor space.

2. Certain advantages of stable flooring, and ventilation for tropical areas are noted.

3. A simple modification of the usual illuminating gas Bunsen burner is described for operating these burners with acetylene gas.

4. A very satisfactory, but simply constructed microscope lamp is illustrated.

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PREPARATION AND USES OF A 6-PERCENT SULFANILAMIDE OINTMENT

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The use of 6-percent sulfanilamide ointment in the treatment of burns was discussed in a previous paper. The purpose of this paper is to discuss the properties of the ointment and to describe its preparation and uses.

The ointment is semisolid, smooth, and very easy to spread. There is little difficulty in incorporating powders in it. It adheres to the skin and can be worked into fissured skin readily. The physical characteristics of this ointment are considered as between those of petrolatum, that is, entirely immiscible with water, and the water soluble tragacanth glycerin jellies or vanishing creams.

The active ingredient is retained to a great extent within the ointment, but penetration into the deeper layers of the skin in a high local concentration is possible. The highest blood level was 3.2 mg. percent sulfanilamide in a burn, largely third degree, involving 22 percent of the body.

The ointment contains sodium borate, which being a salt of a strong base and weak acid, will buffer the ointment on the alkaline side. This is a desirable feature for three reasons: (1) Wound healing is optimum at pH 7.3 (*1*); (2) the activity of sulfonamides increases with an increasing pH; (3) almost all bacteria infecting skin surfaces, except pyocyaneus, grow best on the acid side. Incorporation of powdered calcium carbonate into this ointment will give a more efficient buffer reaction.

Sulfanilamide was chosen in place of the other sulfonamides because of its greater solubility and because it is most effective for local use (*1*). The addition of sulfonamide potentiators (*2*) (*3*) (*4*) (*5*) like azochloramid and sodium tetradecyl sulfate was considered, but the technical difficulties and oxidation of other agents by the azochloramid did not permit their use.

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Lanolin was considered desirable because of its well known emollient properties and beneficial effect on chapped and irritated skin. However lanolin alone was too thick and it was too difficult to incorporate powdered ingredients into it. Hence it was decided to incorporate cold cream as a thinner. The resulting base was most satisfactory and the following procedure has been adopted.

Preparation.—At first it was considered necessary to autoclave the ointment because positive cultures of Bacillus subtilis and Proteus vulgaris were obtained after mixing the ingredients. However, this resulted in the formation of rough masses of sulfanilamide crystals that could not be avoided. Next the ingredients were autoclaved separately and then mixed under sterile technic, but this procedure proved impracticable. The following method however is applicable at any dispensary, base hospital or aboard ship.

The ointment consists of:

	Gm. or cc.		Gm. or cc.
White wax	100	Water	425
Anhydrous lanolin	454	Borax	3
Mineral oil	425	Sulfanilamide	90

The wax and lanolin are melted together. After they are thoroughly mixed, the mineral oil is added and stirred until a homogeneous mixture is obtained. The borax is dissolved in water, and the resulting solution is slowly added to the first mixture with continuous stirring. These mixtures must be combined very slowly, otherwise the mixture will spatter. It is boiled for 15 minutes, stirring constantly before the sulfanilamide powder is added, continuing the stirring until the mixture is homogeneous and cool enough that separation will not occur.

Many cultures have been taken of the above ointment after storage for as long as 10 weeks, but all have been negative for aerobic and anaerobic organisms.

Uses.—This ointment was at first used only on burns, and the other commercial sulfonamide ointments were used on pyodermas, abrasions, denuded surfaces, etc. Recently this ointment has been found to be even more valuable than some of the other sulfonamide ointments, and can effectively replace ammoniated mercury. It has been most efficacious in the treatment of the following:

1. Around furuncles and carbuncles to protect surrounding skin.
2. Impetigo.
3. Abrasions and contusions.
4. All pyodermas.
5. Dressing for pinch and split thickness skin graft donor sites.
6. All burns, except the eyes.

It is not effective against pyocyaneus.

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SUMMARY

1. The preparation of a 6-percent sulfanilamide ointment is described.

2. The reasons for the use of sulfanilamide and the other ingredients are briefly discussed.

3. The conditions in which this ointment has been successfully used are listed.

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INDICATIONS FOR INTRAVENOUS AND RETROGRADE PYELOGRAPHY

In general, the indications for intravenous pyelography are: (a) in the differential diagnosis of obscure abdominal pain or tumor; (b) in patients for whom cystoscopy is contraindicated or impossible because of physical condition; (c) in preliminary examinations which are to be followed by retrograde pyelography if necessary, as in examination of tuberculous patients, patients with traumatized kidneys, or in children; and (d) where retrograde examination reveals some congenital anomaly in the urinary tract, such as double pelvis, only part of which is visualized by the retrograde study.

Retrograde examination is indicated: (a) when study of the condition of the bladder or urethra is paramount; (b) when the source of hematuria or pyuria is to be localized and cultures from each side are to be made; (c) when intravenous pyelography is contraindicated or would be worthless because of poor kidney function; and (d) where excretory urography was used and found wanting.—COLE, F. H., and LANG, E. F.: Indications for retrograde and intravenous pyelography. Harper Hosp. Bull. 2: 1–5, January 1944.

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CULTURING THE GONOCOCCUS

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The use of penicillin in gonococcal infections has emphasized the importance of culturing Neisseria gonorrhoeae for adequate compilation of data in the evaluation of the drug. When suitable precautions and methods are observed the culturing of the organism is not difficult. Failure to observe the correct precautions, however, will lead to unsatisfactory results. The purpose of this article is to demonstrate certain variations of technic which aid in the successful growth of N. gonorrhoeae.

It has been found (*1*) (*2*) that 10 to 15 percent of the strains of gonococci isolated from clinical cases of gonorrhea required a growth factor present in blood and extracts of liver and yeast that is destroyed on autoclaving. Chocolate agar prepared from dehydrated hemoglobin is not suitable for the growth of these strains due to the destruction of the factor during autoclaving. The factor has been demonstrated (*3*) to be glutamine. In this laboratory therefore sterile human whole blood is added to the agar base prior to the pouring of the plates. The blood used is citrated blood rejected by the blood and plasma bank because of undue cloudiness of plasma. Bacto Proteose No. 3 Agar Dehydrated is the base medium employed. Two hundred cubic centimeters double strength agar, pH 7.3, are prepared, autoclaved at 15 lbs. pressure for 30 minutes, cooled to 90° C. in a water bath, and 20 cc. sterile blood is added while the medium is agitated to obtain an even suspension. The agar is cooled to 50° C. in a water bath, poured into sterile Petri dishes in 15-cc. amounts and allowed to harden. The dishes then are inverted and stored in the refrigerator. Since moisture is essential for the growth of the organism, plates are made frequently and in small batches to insure prompt use. In this manner drying out of the agar is prevented.

Cultures are taken before and after the administration of penicillin. Inasmuch as penicillin is indicated in patients whose infection is resistant to the sulfonamides, and thus may be assumed to have received them, it is essential that the possible presence of sulfonamides in the secretions be guarded against to prevent inhibition of growth of the organism. Primary cultures are therefore taken at a suitable

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interval after the sulfonamides have been discontinued and prior to the administration of penicillin. Five-tenths milligrams percent of p-aminobenzoic acid may be added to the medium to neutralize the sulfonamides, but prior cessation of sulfonamide therapy is the preferred method. Final cultures are taken 12 to 18 hours after the last dose of penicillin has been administered, to prevent possible inhibition of growth by traces of the drug.

When requests for cultures are received, the chocolate agar plates are taken from the refrigerator, warmed in the incubator at 37° C., and sent to the ward, where the urethral, prostatic, or conjunctival secretions are streaked directly onto the plate with a sterile wire loop. All cultures are made directly onto the medium; intermediary suspensions of secretions in saline or swabs of the material are not employed. The plates are returned to the laboratory immediately, inverted, and incubated in a moist atmosphere of approximately 10-percent carbon dioxide for 24 to 48 hours. Ten-percent carbon dioxide tension is produced through the use of a candle jar; moisture is provided by a small, damp cotton sponge placed in the jar.

In reporting results, use is made of the "oxidase" reaction followed by a confirming Gram's stain. For the "oxidase" test a 1-percent aqueous solution of p-aminodimethylaniline monohydrochloride is prepared daily. Neisseria gonorrhoeae colonies undergo a series of color changes—pink, maroon, and black—when the plates are flooded with the developing solution. If subcultures are desired, colonies are picked before they turn black, since the solution kills the organism at this point. The Gram reaction is not affected. The plates are observed for 15 minutes before discarding. No attempt is made to identify N. gonorrhoeae colonies through direct inspection alone; the "oxidase" reaction is always used.

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COTTON SUTURE MATERIAL

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ALBERTO MEJIA, M. D.

Cotton as a suture material represents a decided surgical advance. The present difficulties in procuring commonly used sutures should focus attention on this readily available material and promote a more general use.

The cotton is the ordinary spool variety, and its use is advocated by Meade and Ochsner (*1*), who, however, claim no originality. Susruta recommended cotton for the suture of wounds of joints and the abdomen about 500 B. C. Before using cotton the paper of Meade and Ochsner (*2*) should be consulted. It deals with the questions of tensile strength, tissue reaction, wound healing and the bacteriology of cotton as compared with the commonly used suture materials. Briefly it is concluded that cotton is a pliable easily-sterilized, nonirritating, inexpensive suture of sufficient strength in the recommended sizes for most surgical procedures.

It is a suture for "team work" and failure to adhere to certain principles will result in abandoning the material after two or three trials.

The following suggestions are applicable to cotton from its sterilization to the termination of its use.

1. All sutures are wound on moderately pliable split rubber tubing and sterilized by boiling for 20 minutes immediately before use. Cotton contracts on heating, and the employment of rigid spools, glass or wood, results in decreasing the tensile strength by tearing the fibrils. Sterilization before operation permits the use of wet sutures, which are stronger than dry.

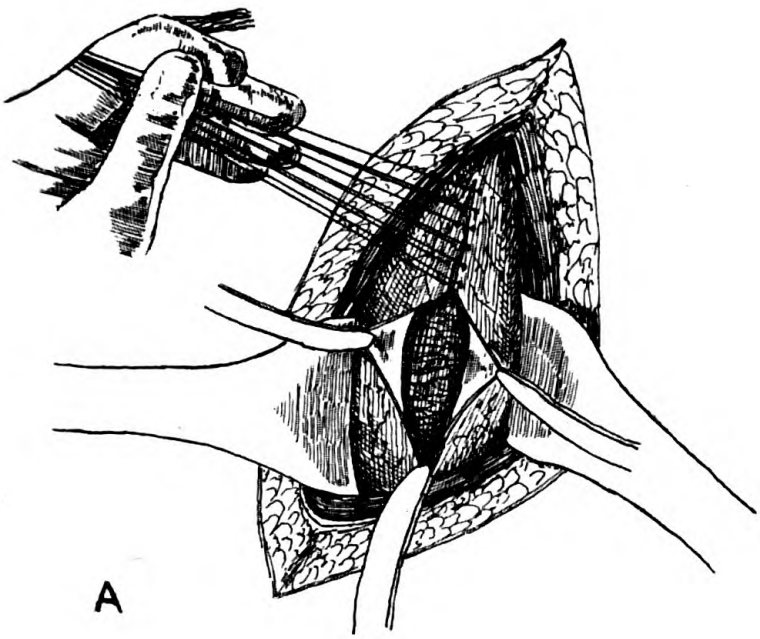
2. The different types are threaded by a nurse before actual use and are kept in separate towels. This speeds the procedure.

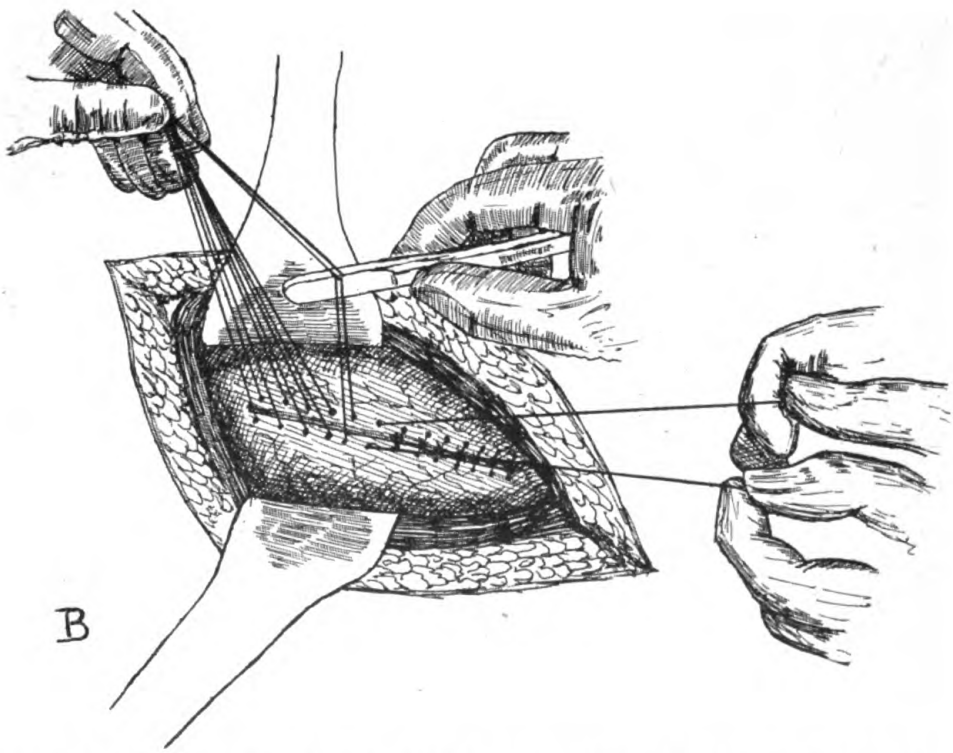
3. Ordinary white spool cotton is recommended, as black dye is not always "fast."

4. Interrupted sutures are used and several needle holders facilitate their application.

5. Sutures are placed, held by the assistant, but not tied until the whole row is completed. This permits approximation of the tissues by the combined pull of all the sutures and makes the closure

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A. The sutures being placed and held by assistant. All sutures are placed before tying.

B. Approximation of wound edges by combined pull of all the sutures permits tying with little tension.

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merely a matter of tying knots under little tension. In this way fragile sutures can be used in place of heavier ones with better results. Failure to do this will result in many broken sutures and ultimate discouragement or the employment of unnecessarily heavy material.

6. A triple knot is employed and all sutures are cut after the row is tied. Therefore one need have no fear of cutting directly on the knot and even less material remains in the wound.

7. The following sizes of thread are recommended but may be varied under different circumstances:

	Number
Peritoneum	60
Fascia	40
Blood vessels (small)	80–100
Ligation of larger vessels, such as the uterines and vessels in the broad ligament	30 or 10

8. Catgut should not be combined with cotton. If cotton is indicated it should be used throughout; if in doubt, catgut should be employed.

Meade and Oschner report 196 operative procedures, with primary healing in 191. There were 3 serious and 2 minor postoperative infections with no sinus formation.

Localio and Hinton (*3*) report 50 major surgical procedures in which cotton was used. In 8 of these infection was present; 3 cases developed wound complications, 2 of which healed without sinus formation. In 1 instance, a case of tuberculous lymphadenitis, a sinus developed from which cotton was extruded.

It is stated that cotton does not form sinuses because granulations cannot grow between its strands due to their tightly wound character: it is this fact which causes persistent sinuses with silk sutures. This has not been verified in our experience. Five cases developed sinuses which persisted from 3 weeks to 3 months and did not cease draining until the cotton was removed or extruded.

These were all potentially infected types, an appendectomy for potentially gangrenous appendix (3 weeks), drainage of a mesenteric abscess (3 months), and 3 severed tendons repaired 12 hours after injury (3 weeks to 3 months). All of the so-called clean and some of the infected cases healed by primary intention.

Table 1 summarizes this series.

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TABLE 1.—*Summary of operations*

Amputations	3	Ligations, tubal	44
Appendectomies [1]	21	Perineorrhaphies	3
Biopsies	5	Pilonidal cysts	3
Cholecystectomies	2	Salpingo-oophorectomies (ectopic pregnancies-5)	17
Circumcisions	2	Splenectomies	2
Incision and drainage abscess [1]	4	Tenorrhaphies [1]	7
Episiotomies	2	Thyroidectomies	2
Exploratory laparotomies	7	Varicose vein resection	3
Gastro-intestinal procedures (Gastroenterostomy—gastric resection—enterocolostomy—resection intestine)	4	Varicocele resection	5
Herniorrhaphies (Umbilical—femoral—inguinal—ventral)	38	Wounds, suture of	6
Hydrocelectomies	7	Total	195
Hysterectomies (Suprapubic—total—vaginal)	8		

[1] Sinus formed.

From this series of cases the following conclusions are drawn:

1. Cotton should be used in clean cases only; its use in infected cases does result in sinus formation.

2. Because of the necessity of removal, it is not practical in cases where nonabsorbable material is difficult to remove, such as episiotomies and circumcisions.

3. Approximation of skin can better be done with clips. When cotton sutures are removed, occasionally a fibril is retained in the suture tract, which leads to mild drainage until it is found and removed.

As one observes these cases during their postoperative course, the following advantages are evident:

(a) The complete absence of any liquefaction in the wound.

(b) The smooth, painless, pliable nature of the resultant scar.

(c) The mildly febrile response of most patients. This is indirectly attributable to cotton, because one does not hesitate to bury many sutures in securing absolute hemostasis; also the relative fragility of the suture prevents any rough tying with resultant strangulation of tissue.

The cheapness of the material is an economic advantage. Meade and Long (*4*) included in their report the following cost study:

> Cotton was used by members of the Tulane Surgical Staff in 100 surgical procedures at an average cost of 1¼ cents for 25 yards (22.8 meters) required in each operation. Silk was employed in 78 operations at an average cost of 93 cents for the 25 yards. An average of 6 tubes of catgut was used in each of 469 operations at a cost of $1.16 per operation. The total cost of suture materials for 1 month at Charity Hospital was found to be $618.06. If this month can be taken as representative of the whole year, the cost per annum of suture materials at Charity Hospital can be estimated at $7,416.72. Use of cotton in the same number of procedures would have cost only $79.91.

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CONCLUSIONS

1. Cotton is a satisfactory suture for use in all types of noninfected surgical procedures from the standpoint of wound healing, cheapness and availability.

2. The employment of cotton results in technically better surgery.

3. Sinus formation can be expected to follow its use in infected cases. In 440 cases reported in this and previous papers 6 sinuses developed (1.3 percent).

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BRUCELLOSIS THERAPY

From the statistics and opinions herein presented the value of sulfonamide therapy in brucellosis is as yet unproved. It is impossible to form any valid opinion from such a small series of cases, but the weight of the evidence would seem to be on the side of those who feel that the sulfonamides are not indicated in the treatment of human brucella infections. Brucellosis is a disease characterized by spontaneous remissions and relapses, and any form of therapy must be evaluated with this in mind. When the first reports on sulfonamide therapy appeared in the literature, they were almost entirely favorable, but each author reported only a few cases (usually one) with a follow-up observation period of never more than a year, and usually only a few months. As more complete reports appeared it was seen that not only was the percentage of complete success less than it first appeared, but the number of relapses was significant. Inasmuch as the sulfonamides are toxic drugs it would seem that their use in brucellosis is questionable. Brucellin and vaccine have been tried over a period of many years and proved successful in much larger numbers of cases than have been included in the sulfonamide reports. Their indications and contra-indications are definite, and the low toxicity is proved.—URSCHEL, D. L.: Sulfonamide therapy in brucellosis; review of literature. J. Indiana M. A. 37: 57–59, February 1944.

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A DISPENSER FOR LIQUID SOAP

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A dispenser for liquid soap in an operating room aids the surgeon in his preoperative scrubbing of hands. In time of war, with limited supplies in a dispensary, a useful soap dispenser can be rigged up with a minimum of trouble.

The essential equipment consists of: A 1,000-cc. flask, rubber tubing ⅜ inch in diameter, glass tubing, and an atomizer bulb with a two-way valve. These can be supplemented with a stand which any carpenter can provide.

The apparatus may be assembled as follows:

1. Any bottle similar to one which is used for commercial intravenous solution makes a satisfactory container for the soap. This is equipped with a rubber stopper with two holes.

2. A short piece of glass tubing is bent to a 45-degree angle and inserted into the stopper with its end above the level of the liquid.

3. One end of a piece of ⅜-inch rubber tubing is attached to the free end of the glass tube and the other end is fastened to an atomizer bulb. It is necessary to have a valve in the bulb to prevent back suction.

4. Another piece of glass tubing is bent to a 60-degree angle and passed through the second hole in the stopper. This tubing extends to the bottom of the bottle. The projecting end is 8 inches long and may be tapered to a point over a flame. The tip may be turned in any direction. If the outer end drops below the fluid level, siphonage will result.

The dispenser is usable in this form, with the bottle on a shelf and the bulb on the floor; however, a separate stand for the bottle improves it usefulness.

This may be constructed by using an upright 36 inches high and 2½ inches square secured to a 10- by 12-inch base. There is a circular cuff of 4½-inches diameter at the top made to fit the bottle, and sides are 2 inches high to prevent it from being upset.

A small triangular compartment at the base is covered by a foot pedal, 6 by 7 inches. This pedal has a block cut on its underside to fit over the rubber bulb. A slanting hole of ⅝-inch diameter is bored in the upright, from the compartment. A groove in the back of the upright will conceal the rubber tubing. Another hole may be bored

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in the back of the circular top to allow the rubber tubing to come through.

If the pedal is too narrow, it will not permit the foot to depress it. This can be overcome by placing a spool on top of the pedal.

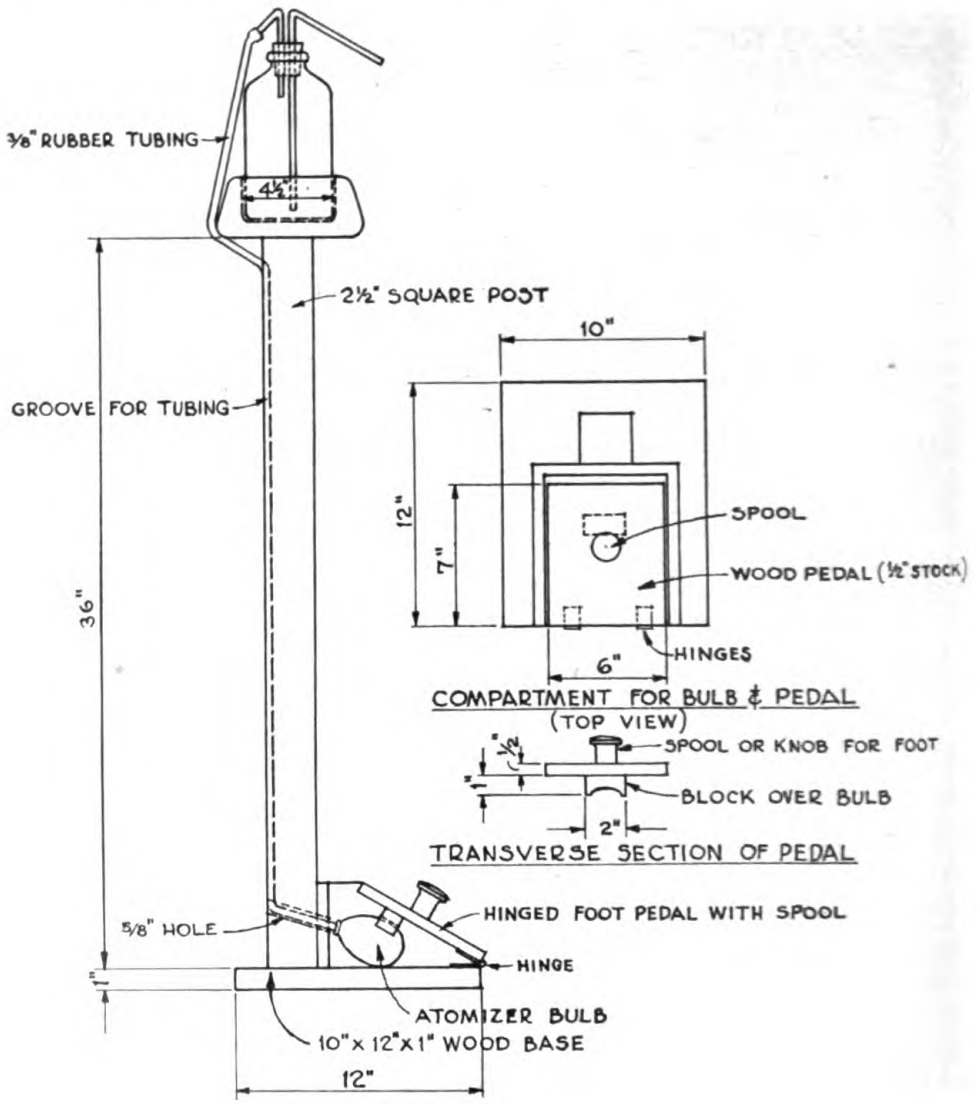


DIAGRAM OF LIQUID SOAP DISPENSER

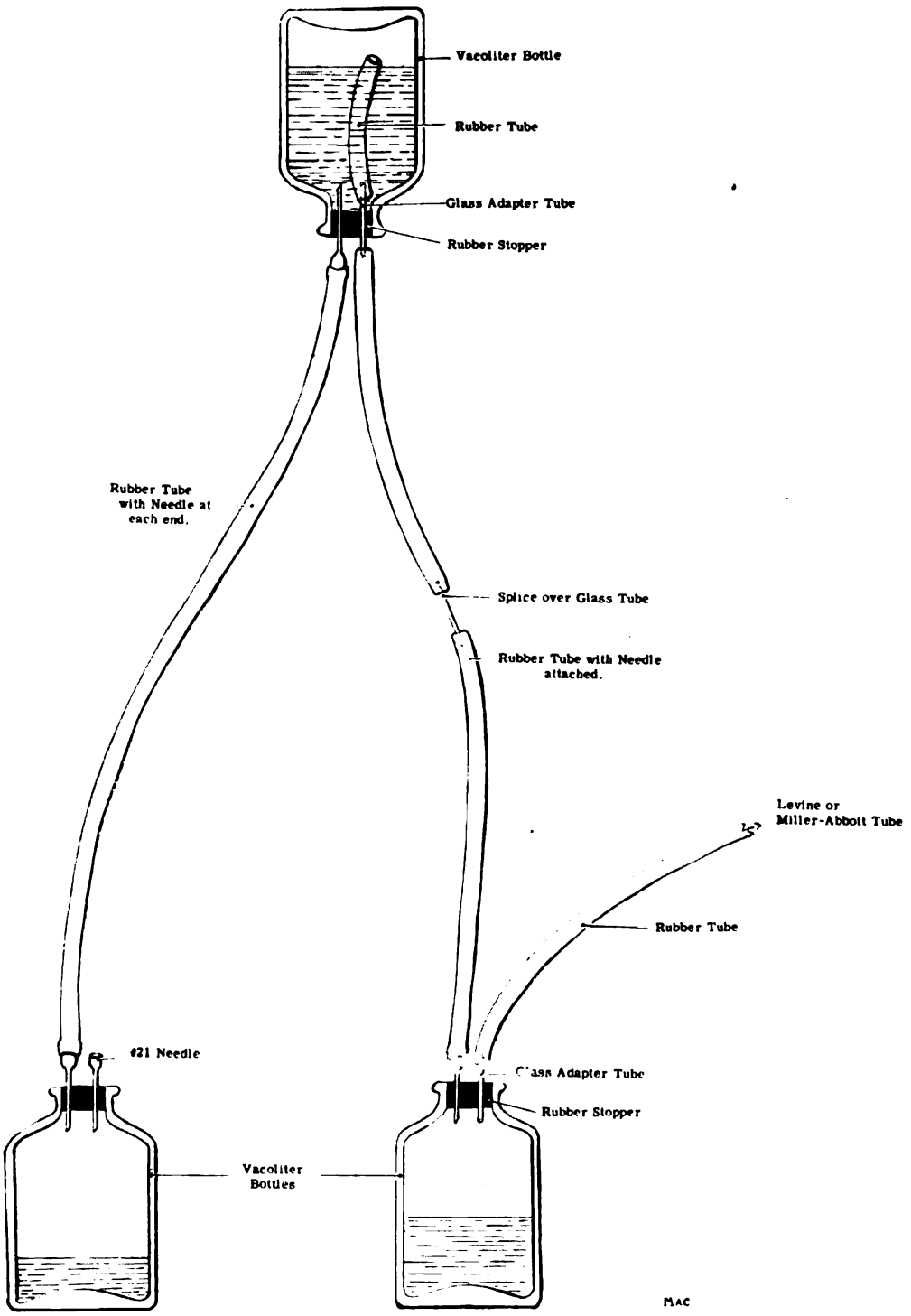
The unit is simple to assemble, and can easily be cleaned. The stand permits moving from place to place and allows use in an emergency room for washing wounds.

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IMPROVISED WANGENSTEEN SUCTION APPARATUS

RICHARD L. THIRLBY
Lieutenant (MC) U. S. N. R.

In small outlying Naval dispensaries materials are often limited. An occasion recently arose for a Wangensteen suction apparatus, but



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the necessary material was not available among the consigned supplies. However, by utilizing discarded plasma bottles, and tubing with attached needles from used plasma outfits, an efficient and satisfactory Wangensteen suction apparatus was improvised.

The glass tubing is usually broken when removing the rubber corks from the plasma bottles. It is suggested that a small end of the tube in the upper bottle be left in the cork and sealed off by heating over a gas flame. If the glass tube is removed from the cork completely, air will leak into the system through the old needle hole. In the two places in the apparatus where glass tubing must necessarily pierce the stoppers the glass adapter that accompanies the plasma sets is forced through the cork so that the short piece of rubber tubing can be held in place as illustrated.

In the event that the lengths of rubber tubing are too short, the ends can be easily spliced over a piece of glass tubing from the plasma bottle and secured with adhesive tape.

It is further suggested that after using the dextrose and plasma outfits, a few of each be kept on hand in order that the described or a similar apparatus may be set up should the need arise.



CHEWING GUM FEVER

After tests for undulant fever, typhoid, malaria, etc., on a child had proved unrevealing, discontinuance of the use of chewing gum reverted the temperature to normal. An entire family troubled with fever, their temperature became normal when their chewing gum habit was discontinued. Contact with a chewing gum manufacturing company brought out the experimental evidence that an average rise in oral temperature of 0.4° F. is had after 5 minutes of chewing. The range of temperature change was from 0.4° F. to 1.2° F. No other factor except chewing seemed to have any correlation with the rise. Experiment with paraffin and dry crackers provoked the same effect. Ten minutes after the chewing the temperature returned to normal.

Hence it was concluded that chewing produces a physiologic elevation of oral temperature; the amount of elevation depends upon the amount of muscular effort used in chewing.

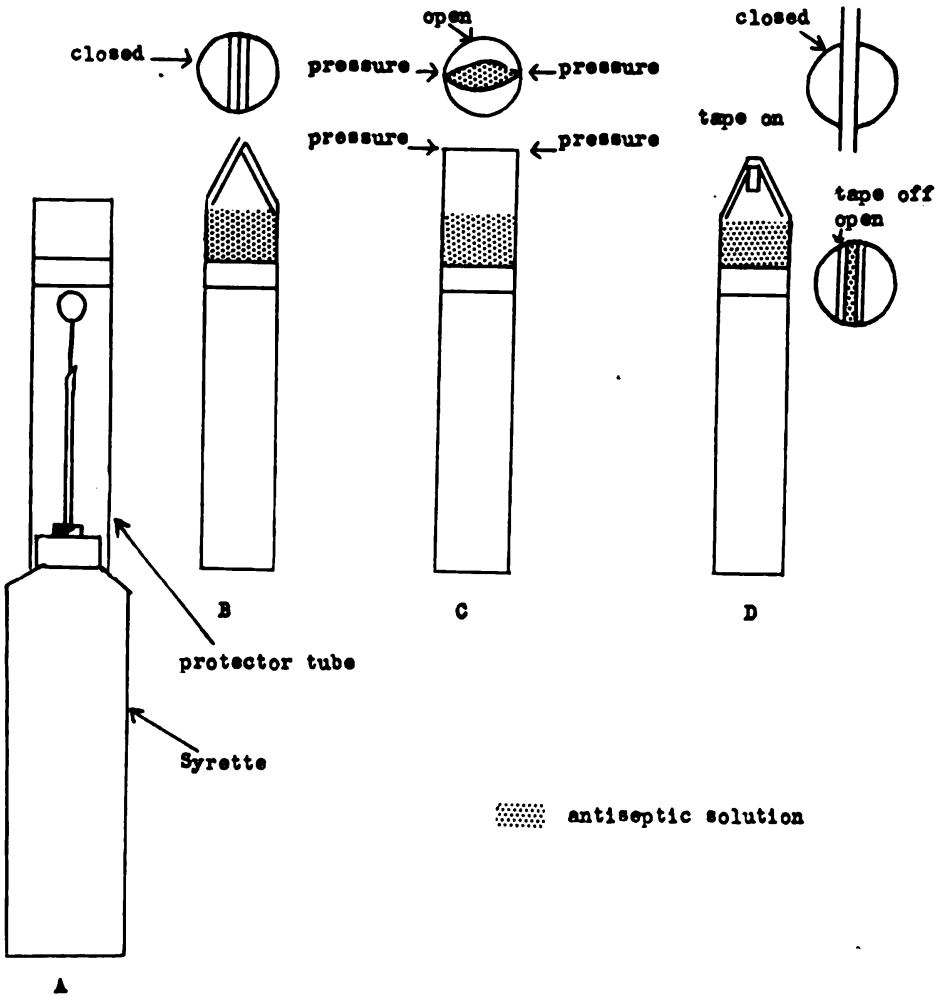
Chewing gum therefore can produce a false fever that may confuse a diagnosis.—SEARCY, H. B.: Chewing gum fever. J. M. A. Alabama 13: 266–267, February 1944.

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ANTISEPTIC APPLICATOR FOR USE WITH MORPHINE SYRETTE

TRUMAN O. ANDERSON
Lieutenant Commander (MC) U. S. N. R.

In an effort to supply an antiseptic for convenient use with the morphine Syrette the following device is suggested. The tube which is used to keep the Syrette sterile is provided with a plug which is inserted and sealed in place at about ⅜ to ½ inch from the top of the tube as shown in illustration A. The antiseptic solution is then dropped or injected into this compartment of the tube, the end of the tube being pinched off and sealed with cellulose acetate (B).



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When the antiseptic is to be used, pressure is applied upon the ends of the pinched tube, thus opening the sealed end, and the antiseptic is applied as shown in illustration C. Another method of providing an easy way of opening the end of the tube would be to incorporate a piece of cellophane tape in the cellulose acetate solution across the end of the tube. When the antiseptic is to be used the tape is pulled, thus opening the lips of the tube by removing the sealing compound (D).

There is another variation of this device which is simpler to make but requires the use of a stick of semisolid material, such as a combination of waxes and oils, in which the antiseptic is incorporated. This stick should be of such composition that it will not melt in the tropics or become too hard for use in cold climates.

The stick applicator is made by inserting a plug in the protector tube, then a stick of the antiseptic pencil, with a covering cap of plastic material. The applicator can also be used as a marking pencil to indicate that morphine has been given.

INDICATIONS FOR GALLBLADDER OPERATION

Frequently recurring biliary colic without jaundice, with or without enlargement of the gallbladder.

Enlargement of the gallbladder without jaundice, even unaccompanied by great pain.

Persistent jaundice ushered in by pain, when recurring pains with or without ague-like paroxysms render it probable that the cause is a gallstone in the common duct.

Empyema of the gallbladder.

Peritonitis starting in the right hypochondrium.

Abscess in the region of the gallbladder or bile ducts, whether in the liver or under or over it.

Some cases in which, although gallstones may have passed, there remain adhesions which cause pain and discomfort.

Mucous, mucopurulent or biliary fistulas.

Certain cases of chronic jaundice with a distended gallbladder dependent on some obstruction in the common duct, even though a suspicion of malignancy is entertained.

Phlegmonous and gangrenous cholecystitis, if recognized sufficiently early.

Gunshot or stab wounds over or involving the gallbladder.

Suspected rupture of the gallbladder.

Persistent cases of chronic catarrh of the gallbladder or bile ducts.

Infective and suppurative cholangitis.—MAYO-ROBSON: Quoted by WEISS, S.: Clinical Lectures on the Gallbladder & Bile Ducts. The Year Book Publishers, Inc., Chicago, Ill., 1944. p. 292.

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FIRST-AID JACKET

JOHN T. SORENSEN
Lieutenant Commander (DC) U. S. N. R.

A first-aid jacket was developed as a practical answer to the disadvantages experienced in working from a first-aid kit. It is made of canvas and although it appears bulky it is possible for the wearer, fully equipped with life preserver, belt and pistol, to get through a hatch 18 inches in diameter. The jacket can be altered for individual size by tie lines on each side. It is inexpensive and can be made aboard ship with the material at hand.

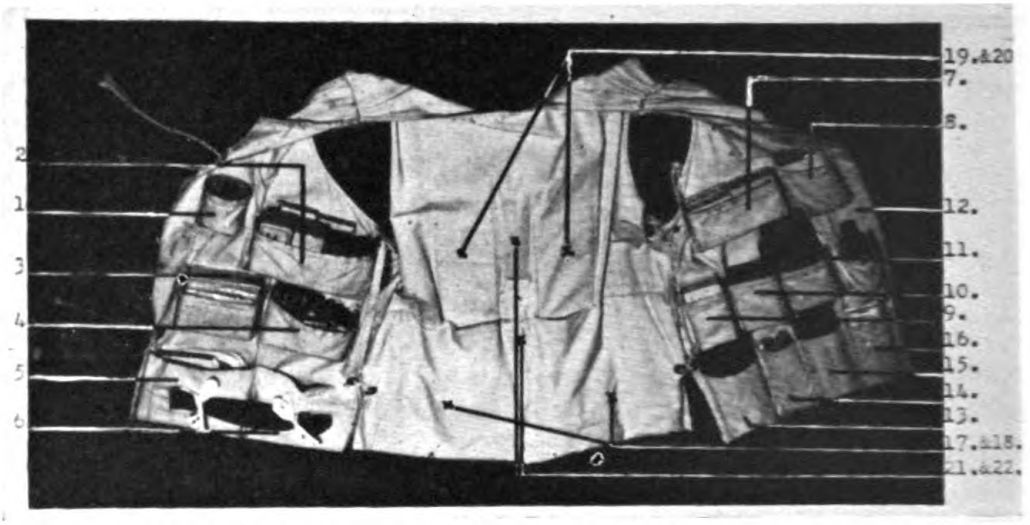
The jacket as shown in the figure is a vest type permitting both arms to be free, with the weight resting equally on both shoulders. It is held together by tie lines, fitting the jacket snugly to the body and permitting accessibility to inside compartments.

Two types of splints are carried on the back of the jacket; i. e., the basswood board splint and two wire splints. Beneath these splints, in the fashion of a hunting coat, are two pockets accessible from either side for carrying triangular bandages.

The following advantages were found for the jacket over the first-aid kit:

1. The jacket is designed to accommodate the required articles found useful in rendering efficient first-aid treatment during battle.
2. It is unnecessary to empty the jacket in order to find the articles immediately needed.
3. A greater quantity and variety of supplies can be carried.
4. It is possible to reach automatically into the particular compartment containing the specific articles needed. This is especially handy during blackout.
5. The jacket permits sufficient freedom for the handling of patients.
6. It is easy to check required items.
7. It provides for greater accessibility of contents.

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Showing the jacket open. The different compartments and contents are as follows:

1. 1 adhesive plaster (2 inches by 5 yards).
2. 2 gauze bandages (3 inches by 10 yards).
   2 head dressings.
   2 tourniquets, web.
3. 2 battle dressings, small.
4. 4 gauze bandages, compressed (2 inches by 6 yards).
   4 gauze bandages, compressed (3 inches by 6 yards).
   4 plain gauze, compressed (1 yard long).
5. 1 battle dressing, large.
   2 dozen history tags.
6. 1 battle dressing, large.
   2 dozen morphine tags.
   1 rubber tourniquet secured to pockets.
7. 4 boxes (5 Syrettes each) 1.5 cc. ½ grain morphine tartrate.
8. Sulfanilamide powder.
9. 2 boxes (4 each) ammonia ampules and cups (2 cc.).
10. 4 tubes aromatic spirits of ammonia.
    3 units of 10-cc. iodine applicators.
    1 pair scissors.
11. 2 two-cc. syringes and 6 needles.
    4 ephedrine sulfate, ¾ grain.
    4 epinephrine hydrochloride sol. 1:1,000, 1 cc.
12. ¼ pound chloroform.
13. 1 pocket case (MD–USN).
    Safety pins.
14. Sulfathiazole cream, 5 percent.
    1 dozen tongue depressors.
15. ¼ pound roll cotton.
    1 dozen cotton applicators.
16. Tannic acid or sulfathiazole microcrystals.

17 and 18. Compartments for triangular bandages, 1 dozen in each.

19 and 20. Compartments for wood splints, 5 in each.

21 and 22. Compartments for 2 wire splints.

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EDITORIALS

INFECTIVITY OF HOSPITAL DUST

Concentration of military personnel having open wounds has focused attention on cross infections in hospital wards. De Waal's[1] observations on the increased incidence of infection proportionate to the frequency of dressing changes, and his experiments illustrating the type and degree of contaminations, have removed the problem from the realm of speculation. Just how far dust is responsible for this situation was first demonstrated by Cruickshank who found that hemolytic streptococci could readily be cultivated from the air and dust in the burn wards of the Glasgow Royal Infirmary.

It has been shown by a number of authorities that sweeping of floors and bed making in hospitals increase the numbers of streptococci recoverable in culture plates exposed to the air. Thomas[2] found that the number of hemolytic streptococci swept up from various parts of a clean, well-kept ward on a particular morning amounted to nearly 102,000,000 organisms, and it has been demonstrated that the survival time of organisms in air-borne dust has been as long as 10 weeks, their virulence remaining undiminished after 25 days. Diphtheria bacilli, moreover, have survived in stored dust, retaining their virulence for as long as 102 days.

A mode of infection in hospitals and one not commonly suspected is that which occurs when air currents created by the movement of the patient in bed pass from below the bedclothes over exposed wounds during dressing changes.

These examples and figures illustrate the very high concentrations of virulent organisms and potential wound contaminants encountered even under clean hospital conditions; unless they are effectively dealt with they may provide a semipermanent reservoir of infection for succeeding patients in the same ward.

The problem is not one to be dismissed with a shrug, particularly when it has been demonstrated that 86 percent of wound cases under treatment in hospitals become infected.

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[1] DE WAAL, H. L.: Wound infection; preliminary note on combined clinical and bacteriological investigation of 708 wounds. Edinburgh M. J. 50: 577–588, October 1943.

[2] THOMAS, J. C.: Reduction of dust-borne bacteria by oiling floors. Lancet 2: 123–127, August 2, 1941.

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Furthermore it has been shown that simple oiling of floors beneath the bed materially reduced contaminants, and treatment with an antiseptic resulted in complete elimination of the organisms.

Despite these experimental evidences clinicians are hesitant to accept the findings and little is being done in this country to correct the situation.

The problem, however, has resolved itself into two phases—the contamination and control of droplet spread, and dust dissemination. The first of these naturally evolves into the latter if left unchallenged. The three classic agents, sodium hypochlorite, resorcinol, and glycol as air controls are currently exploited in Britain, and Krueger's work with glycols as presented in this issue (p. 1288) gives an authoritative appreciation of these substances.

The exigency of war has made medical men in Britain aware of the necessity of controlling the dissemination of dust in wards, medical canteens and air raid shelters. Van den Ende [3, 4] suggested the use of oils on floors and bed linen with encouraging success. Treatment of the floors in operating rooms with a strong antiseptic solution is rather common practice in this country but swabbing beneath beds in hospital wards has never been an accepted cleaning routine. Garrod's [5] findings of the elimination of hemolytic streptococci beneath the bed of a scarlet fever patient by treating the floor with ordinary antiseptic warrants a more general adoption of this method.

It is claimed that microorganisms can be removed from the air by ultraviolet light at a greater rate than that attainable by any mechanical ventilation. The use of ultraviolet light has yielded encouraging results despite the fact that the field is only recently developed. The bactericidal action of ultraviolet rays from sunlight or special lamps has been experimentally investigated in children's hospitals, operating rooms, schools, and currently at a Naval hospital.

Garrod has shown that daylight alone may be of material value in reducing the incidence of dust-borne infection. Good lighting as a measure of sepsis control is definitely demonstrated. Dark corners in the floors of infected wards yielded consistently contaminated dust, whereas dust on or close to windows never contained pathogenic organisms whether exposed to direct sunlight or not. Preoccupation with ultraviolet light led to the assumption that it alone was responsible for the bactericidal effect. It must now be recognized

[3] VAN DEN ENDE, M.; LUSH, D.; and EDWARD, D. G. F.: Reduction of dust-borne bacteria by treating floors. Lancet 2: 133–134, August 3, 1940.

[4] VAN DEN ENDE, M.; EDWARD, D. G. F.; and LUSH, D.: Reduction of dust-borne bacteria in ward by treating floor and bedclothes. Lancet 1: 716–718, June 7, 1941.

[5] GARROD, L. P.: Some observations on hospital dust with special reference to light as a hygienic safeguard. Lancet 1: 245–247, February 19, 1944.

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that ordinary diffuse daylight, even on cloudy days and in winter, can be lethal to bacteria, and that glass is no absolute barrier to this effect.

With the tremendous hospital expansion program now in progress and proposed for the future, a consideration of these findings is timely and worth while.

ADENOIDECTOMY AND FRÖHLICH'S SYNDROME

The casual attitude of some toward tonsillectomy and adenoidectomy belittles the seriousness of these operations. The wanton removal of tonsils and adenoids is discussed in a recent British publication [1] and attention is drawn to an apparent wave of promiscuous tonsillectomies and adenoidectomies in Great Britain. It is asserted that in many instances no more indications for these operations could be found than that they were fashionable and a mark of the well-to-do. This conduct seems as tenable as the action of the pediatrician who saw nothing good in the function of these structures and hence had a standard appointment with his surgeon for the removal of the tonsils and adenoids of each of his own children when they reached the ripe age of one year.

The observation that children frequently take on weight after the removal of their tonsils and adenoids implies that these organs are responsible for the underweight and altered physiognomy. Such deduction has a basis in fact. The adenoid facies is an established entity. But that some of these changes may be due to a positive glandular dysfunction brought on by the operation is not generally recognized. There have been cases observed in which gains in weight of a pathologic obesity type, or even the classic manifestations of Fröhlich's adiposogenital dystrophy, followed tonsillectomy and adenoidectomy.

Goldzieher [2] calls attention to this possibility and states that the obesity which is observed subsequent to tonsillectomy and adenoidectomy is of a specific type and bears the characteristics of pituitary disease.

In the light of the pathogenesis of Fröhlich's syndrome, the relationship of the pituitary to the adenoids is deserving of more serious consideration.

[1] Editorial. Tonsils and antibodies. Lancet **2**: 575, November 6, 1943.

[2] GOLDZIEHER, M. A.: Relationship of tonsillectomy and adiposogenital dystrophy. South. M. J. **106**: 39–42, February 1944.

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The development of the anterior lobe of the pituitary from the pharyngeal bursa is reflected in a persistent narrow stalk embedded in the sphenoid bone and connected cranially to the sella turcica. Demonstrable in 10 percent of cadavers, close roentgen study of the sphenoid bone may reveal in the same percentage peculiarity in structure consistent with a patent canal. Anomalies are rarely single. A cadaver with one anomaly, more frequently than not possesses others. A persistent craniopharyngeal duct has been shown to be present when other malformations existed and hence should be made the subject of a thorough search when anomalies are suspected.

The distal end of this craniopharyngeal canal is the site of the pharyngeal pituitary, and the presence of glandular elements in the duct is significant. The cells of this rudimentary structure ordinarily do not possess secretory activity; however paradoxical cases of hyperpituitarism and even acromegaly, in which the pituitary gland proper was not enlarged nor the sella turcica distended, have been attributed to hyperplastic or neoplastic changes in these residual cells.

Despite the ordinarily nonsecretory activity of these cells, with the removal of the adenoids, with traumatization, or with the actual destruction of the pharyngeal pituitary and abolition of whatever function this rudimentary organ possesses, a cellular differentiation and hyperplasia may be initiated. This hypothesis, as Goldzieher suggests, transcends the sphere of probability when a defective pituitary gland either as the result of malformation or of impairment in early childhood is present. As a consequence there sets in a compensatory process in the course of which the cells may assume secretory function.

The abundant lymphatic network of the pharynx is opened by surgical trauma and the spread of a low-grade infection through the lymphatics may produce morphologic changes in the anterior lobe. It is therefore not unlikely that the lymphatics of the patent craniopharyngeal canal may explain the spread of a nonpyogenic or nonsuppurative infection upward to the sella turcica, creating an interstitial fibrosis of the anterior lobe that results in a functional deficiency, and may be responsible for the manifest Fröhlich's syndrome.

The onset of a postadenoidectomy adiposogenital dystrophy takes on a logical explanation by the recognition of the hidden connection between the nasopharynx and the sella turcica.[3]

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[3] GOLDZIEHER, M. A.: Diagnosis and treatment of pituitary disease. Pennsylvania M. J. 45: 687-693, April 1942.

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BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For Review)

NERVOUSNESS, INDIGESTION, AND PAIN, by *Walter C. Alvarez, M. D., Professor of Medicine, University of Minnesota (Mayo Foundation); Consultant in the Division of Medicine, The Mayo Clinic, Rochester, Minnesota.* 488 pages. Paul B. Hoeber, Inc., New York, publishers, 1943. Price $5.

Fortunately, I had just read Stanley Cobb's "Borderlands of Psychiatry," prior to reading this valuable book by a leading internist; thus, I was able to check the case histories and advice of Alvarez with those of one of our eminent psychiatrists. At any rate, I would suggest the reading of Chapter IX, on psychosomatics by Cobb before attempting to evaluate the importance of the psychic factor as presented by Alvarez. Cobb gives us an understanding of psychosomatics by case histories, and Alvarez gives us case histories with accompanying analyses.

A little book, containing four papers by the late Francis W. Peabody (1930) has served as my guide in many diagnostic problems, and he states that, excluding acute infections, approximately half of the patients one sees complain of symptoms for which an adequate organic cause could not be discovered.

Some have considered this book by Alvarez as giving advice to young doctors; others as giving patients an insight to their problems. Probably there are many patients with emotional disturbance made worse by knowing possibilities.

In Chapter XV, Alvarez deals importantly with "Insanity and Related Troubles." He notes that it would astound many a physician if he knew how many mildly but definitely insane persons present themselves for diagnosis and treatment.

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All through the book three lines of diagnosis are indicated: One to so-called medical treatment, one to surgical aid, and one to psychiatry.

A Mayo Clinic colleague told me of an important surgical meeting where Doctor Charles Mayo was to have presided. Sudden illness prevented Mayo's meeting his engagement and Alvarez substituted for him. This surgical colleague and the other surgeons present were astonished at the grasp of surgical problems shown by Alvarez.

The author tells us that many of the chapters in the book were based on questions asked him by physicians who had called him in consultation, and the same frankness given the physician is here open to the inquiring layman.

The old idea that the patient should be kept in ignorance of her condition and prevented from taking part in her treatment is not accepted in this book. Participation of the patient is constantly suggested. I use "her" instead of "his" case because the majority of the case histories deal with women. Physicians, in my opinion, make a great mistake in not dealing frankly with their patients. We have an illustration of the necessity of such a method in the handling of diabetic patients. The frequent demands for laboratory and dietetic observations necessitate cooperation with the patient.

Like Peabody, Alvarez points out the danger of relying too much on the report of some enthusiastic or poorly trained laboratory technician, and insists on the physician's understanding the probability of error in laboratory reports and ability to interpret laboratory findings.

COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION, Volume XXXIV—1942, edited by *Richard M. Hewitt, B. A., M. A., M. D.; A. B. Nerlinger, M. D.; John R. Miner, B. A., Sc. D.; James R. Eckman, A. B.; and M. Katharine Smith, B. A.* 999 pages; 176 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1943. Price $11.

Once again we have this rather unique volume, published annually, and once again it measures up handsomely to its predecessors. As stated in the foreword, the volume is meant primarily for the "general practitioner, diagnostician, and general surgeon."

Of special interest is the section on chemotherapy. This is a complete section and the papers are printed in full. Discussed are the therapeutic effects of sulfapyridine, sulfaguanidine, sulfanilamide, sulfadiazine, promin, gramicidin, heparin, dicoumarin, and even some early work on penicillin. The section on the alimentary tract is also rather inclusive and the papers are particularly practical. The entire field of medicine is covered in this volume and the editors incorporate the more interesting and timely papers written by members of the Mayo Clinic and the Mayo Foundation.

There are 183 articles in full, abridged, or in abstract. In addition, 330 articles appear by title alone, as sources of reference for the reader to enlarge his knowledge. There are 176 illustrations.

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The book itself is bound and printed on fine quality paper in the best "textbook" style. It can be recommended as a collateral reading reference for all Navy medical officers.

THE NATURE AND TREATMENT OF MENTAL DISORDERS, by *Dom Thomas Verner Moore, O. S. B., Ph. D., M. D., Professor of Psychology and Psychiatry, Catholic University of America; foreword by Edward A. Strecker, M. D., Professor of Psychiatry, Graduate and Undergraduate Schools of Medicine, University of Pennsylvania.* 312 pages. Grune & Stratton, New York, publishers, 1943. Price $4.

This volume contains several deviations from the usual textbooks on the subject of the nature and treatment of mental disorders. The first chapter examines the existence of specific psychiatric entities as statistical facts by means of factor analysis of symptoms. Forty psychotic symptoms were first defined and their presence or absence were determined in a group of over 300 patients. The tetrachoric correlations between the symptoms were then worked out. Whether these determinations are of any value remains to be seen.

The chapters which follow deal with the concepts of mental disorders, the type concepts and principles of psychopathology, and the origin and course of some common phobias. The author then describes his ideas of therapy by psychologic analyses and the interpretation of the patient's history by means of free association. Various other attempts at therapy are described, utilizing Myerian, Freudian, philosophic, and religious approaches. The author is apparently well acquainted with various types of psychiatric literature. The chapters on educational and bibliotherapy might have been elaborated upon, for these types of therapy will probably have a place in the newer psychotherapy which will result from experiences gained in this war. The volume would be of little use to medical officers in the military services.

NOTABLE CONTRIBUTORS TO THE KNOWLEDGE OF SYPHILIS, by *Herman Goodman, B. S., M. D.* First limited edition. 144 pages; illustrated. Froben Press, New York, publishers, 1943. Price $3.

This is an excellent sketch of the history of syphilis. The biographic method is used, and the book is in effect a series of thumbnail biographies of the many men who have made contributions to the subject. The arrangement is chronologic, and the first name is that of Moses. Naturally, certain names received more treatment or space than others, as with the case of Fracastoro, who named the disease; Paracelsus, who is credited with the internal use of mercury in the treatment; Morgagni, the first to describe the pathology of syphilis of the internal organs; and John Hunter, whose famous experiment confused the conception of syphilis and gonorrhea, until the two diseases were clearly separated again by Ricord. Wasser-

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mann, Schaudinn, and Ehrlich are not forgotten. Two medical officers of our Navy received mention: Rear Admiral Charles St. John Butler and Captain R. C. Holcomb (MC) USN, who are among the strongest advocates of the European origin, in contradistinction to the theory that the disease originated in the New World and was unknown in Europe before the Columbian voyages. Dr. Goodman has considerable of interest to say on this controversy. There are many pictures, nearly all of them portraits, although a few are of title pages or illustrations from early or famous books on the subject.

BIOMICROSCOPY OF THE EYE. SLIT LAMP MICROSCOPY OF THE LIVING EYE. Volume I. by *M. L. Berliner, M. D., Assistant Professor of Clinical Surgery (Ophthalmology), Cornell University Medical College.* 709 pages; 512 illustrations, including 40 pages of color plates. Paul B. Hoeber, Inc., New York, publishers. 1943. Price $17.50.

Berliner's volume on slit lamp microscopy presents a clear comprehensive text replete with beautiful illustrations. Though the slit lamp is now indispensable equipment for top-flight ophthalmologists, the adequate books on the subject have been of foreign origin and thus, for some time, have been unavailable. The corneal microscope perfected by Czapski proved its value only after Gullstrand contrived a truly focused beam. Before then Norris and Oliver committed themselves to the following prophecy: "The use of the corneal microscope is illusory . . . it is doubtful whether it will ever be useful in examining the living eye." With the Gullstrand beam it became possible to examine the successive layers of the transparent ocular media illuminated by light in exact focus.

The author describes in detail a systematic technic for the most efficient utilization of biomicroscopy. Each structure in turn is fully considered, 127 pages being devoted to the conjunctiva, 77 to the margins of the lids, 283 to the cornea, and 40 to the anterior chamber. The book closes with an ample and admirable chapter on gonioscopy contributed by Dr. H. Saul Sugar.

CLINICAL AUDIOMETRY, by *C. C. Bunch, M. A., Ph. D., Formerly Associate Professor of Otology, Medical School, University of Iowa.* 186 pages; 74 text illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $4.

C. C. Bunch needs no introduction to otologists in this country. He has devoted his entire scientific career since 1917 to the study of otology in general and hearing problems in particular. In this compact volume, he sums up his vast experience and knowledge in order to bring to the practicing otologist the latest accepted principles in the field of audiometry. In this task he succeeds admirably.

Historical chapters deal with the development, advantages, and pitfalls of the classical tuning fork tests, and graphically demonstrate the lack of standardization existing under the old methods.

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Carefully, the development of the modern audiometer is described and its proper use outlined in detail. He does not fail to point out the limitation of all hearing tests and stresses the importance of clinical findings in the evaluation of all cases. This is a sane, unbiased summation of the scientific status of the clinical audiometer today.

The book is attractively bound and printed, and the text is freely interspersed with helpful charts and illustrations. This volume should be in the library of every practicing otologist.

A TEXTBOOK OF EXODONTIA, by *Leo Winter, D. D. S., M. D., F. A. C. D., F. A. C. S., Sc. D. (Hon.), LL. D., Professor of Oral Surgery, New York University.* Fifth revised edition. 576 pages; 485 text illustrations and 7 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $10.

The fifth edition continues to be authoritative about exodontia, oral surgery, and anesthesia.

In the chapters on local anesthesia the author explains and discusses the many types of local anesthetics in use today, giving the indications, contraindications, chemical characteristics, preparation, and sterilization.

Extraoral injection technics, with beautifully illustrated plates, are excellent additions to the revision. These show the detailed structures through which the needle must pass for final disposition and complete success with the anesthetic.

General anesthesia and anesthesia for ambulatory patients are covered for the author by two men experienced in these fields.

The typography and illustrations are good.

PERSONAL AND COMMUNITY HEALTH, by *C. E. Turner, A. M., Sc. D., Dr. P. H., Professor of Public Health in the Massachusetts Institute of Technology.* Seventh edition. 585 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $3.50.

In the seventh edition of this well-known text the author has incorporated suggestions from teachers familiar with the book. Occasional references to living under present war conditions further bring the subject matter up to date. Like many texts purportedly for the college level, it seems far too elementary and abbreviated a presentation for this group, requiring a good deal of supplementary material in the fields of anatomy, physiology, and nutrition whether it is used as a reference work or as teaching material.

In two parts, the first deals with personal health, the second with community health. Included under the former are chapters on oral hygiene, nutrition, circulation, mental hygiene, the hygiene of reproduction, and narcotics and stimulants. In part 2, dealing with community health, are chapters on the "3 great plagues" (tuberculosis, syphilis, and the common cold), food control, ventilation, heating and

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lighting, public health administration, school hygiene, maternal and child hygiene, control of communicable diseases, and the like. It is to be regretted that the use of stock, posed illustrations was resorted to; they detract from the appearance and tone of the volume. Dentists might deplore the use of the older term "canine" teeth and find cause for disagreement concerning prenatal diets.

On the whole the material is sound and the references at chapter ends well selected in their respective fields. The appendix of diseases provides a valuable and quick reference. The two essentially broad subjects of personal and community health are not easily covered in one volume of 585 pages. The job of condensing is well done, but one wonders if the subject has not been spread too wide.

ORTHOPEDIC NURSING, by *Robert V. Funsten, M. D., Professor of Orthopedic Surgery, University of Virginia Medical School, and University of Virginia Hospital School of Nursing, Charlottesville, Va.; and Carmelita Calderwood, R. N., A. B., Consultant in Orthopedic Nursing, National League of Nursing Education, New York.* 602 pages; 181 text illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price $3.75.

The military orthopedic surgeon cannot take it for granted that nurses on his wards have learned the principles of good orthopedic care in their schools of nursing. It is the rare graduate registered nurse who comes to duty in the military hospital with adequate training or experience in this specialty. Medical officers on orthopedic wards do well to hold classes for their ward nurses and corpsmen.

With or without classes, Funsten and Calderwood's Orthopedic Nursing can be of invaluable assistance. It is written by people who know their subject and know how to teach it. As a general orthopedic text, it treats some subjects, such as congenital deformities, which do not enter the military surgical sphere to any extent; but with these exceptions, a large proportion of the book is made up of solid, practical suggestions applicable anywhere. The first 90 pages alone warrant study by every member of the staff. Unit 1 includes the preventive aspects of orthopedic nursing, such as posture, backstrain, and flexion deformities, which apply to all types of patients (and to the nurse herself). The care of the cast and the patient inside the cast (Unit 2), constitute for most nurses an unknown field. They are not aware of the dangers of plaster crumbs, or how to prevent them; they do not realize the hazard a damp cast presents.

The usually difficult subject of fractures, dislocations, and sprains, is made clear by excellent drawings. They demonstrate the mechanical problem in each case, both before and after reduction; the location of the bone fragments is shown, and in separate illustrations, the pull of attached muscles, on which depend the position required for reduction and proper healing. The application of traction, as it may become the

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responsibility of the nurse, and the care of patients in traction, are considered in detail. The section on the prevention and treatment of pressure sores deserves specific mention. Not only in this chapter, but throughout, each point is further explained by unusually descriptive photographs, drawings, and diagrams, many of which have been especially prepared for this text.

One would like to itemize the thoughtful and frequently imaginative care of each of the many conditions discussed. The outstanding characteristic of the book is one well demonstrated by the searching understanding of the patient with rheumatoid arthritis, an understanding of the associated physical, emotional, and sociologic problems. From page 1 through page 559 the patient is considered not as an infected foot, not as an amputation; he is a human being, "with exactly the same rights and privileges, the same fundamental responses to sickness, fear and insecurity, which the nurse has herself." It is a platitude to say that good morale hastens healing; nevertheless, in Naval hospitals, as in civilian, the person is too often overlooked in our preoccupation with the patient. What a gain, if the nurse can learn this with regard to her orthopedic patients!

THE EDUCATION OF NURSES, Historical Foundations and Modern Trends, by *Isabel Maitland Stewart, R. N., A. M., Professor of Nursing Education and Director of the Division of Nursing Education, Teachers College, Columbia University, New York, N. Y.* 399 pages. The Macmillan Co., New York, publishers, 1943. Price $3.50.

With the war spotlight on nursing, this is a logical time to review the education of nurses, learn from the past, and try to plan more intelligently for the future. No one is better qualified for this task than Isabel Stewart, Professor of Nursing Education at Columbia University. She has summarized the history and introduced new material, to point the conclusion apparent today. Although we have need of many nurses right now, lower standards of admission and training can result only in oversupply of unqualified nurses in the future. There is unlimited work to be done by nurses, but the most socially valuable can be done only by those who are fitted for it by character and education.

The Navy does not occupy itself with the basic training of nurses, and it is too busy with day-to-day demands to carry out detailed planning in the training of hospital corpsmen. The book emphasizes to a teacher of hospital corpsmen how much more important it is for one who is caring for the sick and injured to be able to think a matter through than to know a few isolated facts. In this lies the strength of the Hospital Corps being built today—the men and women who make it up are already fairly well-rounded human beings. They are directing their general information and common sense toward their present needs. The result could be a lesson to teachers of nurses.

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TEXTBOOK OF PHYSIOLOGY, by *William D. Zoethout, Ph. D., Professor of Physiology in the Chicago College of Dental Surgery (Loyola University); and W. W. Tuttle, Ph. D., Professor of Physiology, College of Medicine, State University of Iowa.* Eighth edition. 728 pages; 308 text illustrations and 3 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price, $4.75.

This textbook of physiology is well adapted to serve as a teaching text for a brief course (100 hours) in physiology for students of college grade. The subject matter is well selected, well balanced, up to date, exceedingly well outlined and is unusually lucid and accurate for texts in this category. It is suitable for students in dentistry, pharmacy, and physical education. However, students in dentistry and physical education should know more regarding the physiology of teeth and exercise, respectively, than this text presents. The text could be used for students of nursing, though the subject matter is not particularly well selected for such a purpose.

The book is printed well, adequately bound, exceedingly well illustrated with 308 figures. The index, glossary and list of selected references are adequate.

A TEXTBOOK OF ANATOMY AND PHYSIOLOGY, by *Jesse Feiring Williams, M. D., Sc. D., Visiting Professor of Health and Physical Education, University of North Carolina.* Seventh edition, revised. 573 pages; 344 illustrations, 31 of them in color. W. B. Saunders Co., Philadelphia, Pa., publishers, 1943. Price, $2.75.

Some of the outstanding features of this new edition are: It reflects modern teaching trends and the material appears to be logically interwoven to provide a unified picture of structure and function of the organs and systems of the body.

This textbook would seem to serve the requirements of the nurse, the physical instructor or other student of anatomy and physiology outside the medical school.

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PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

INFLUENZA AND PNEUMONIA

1943 COMPARED WITH 1918

DEAN F. SMILEY
Lieutenant Commander (MC) U. S. N. R.
and
HERBERT A. RASKIN
Pharmacist's Mate, first class U. S. N. R.

With subsidence of the recent epidemic of influenza [1] it became of interest to trace its development and view it in relation to the pandemic of 1918 in order to gain a perspective of its size and significance.

1943.—Study of the weekly morbidity report from all shore stations in the continental United States during 1943 reveals that the expected reduction in the incidence of acute catarrhal fever and influenza during the summer months occurred in all Naval Districts except the 13th. In this district the rate for these infections remained high during the summer months and began to rise to epidemic proportions as early as 24 October.

The peak of the epidemic was reached in the week ending 4 December in the 13th, 9th and 6th Districts, and in the week ending 11 December in the 1st, 3d, 4th, 5th, 7th, 8th Districts and the Potomac and Severn River Commands. In the 12th District the peak was reached in the week ending 18 December, whereas in the 11th District this did not occur until the week ending 25 December. For all naval shore stations in the continental United States the peak was reached in the week ending 11 December. The annual rate per 1,000 average strength rose to a point over 1,000 in only the 9th District and the Potomac and Severn River Commands; it failed to rise to 500 in the 7th, 8th, 11th and 12th Districts.

[1] Under the term influenza as of 1943 are also included all cases reported as catarrhal fever, acute. The reasons for this combination are: (1) The clinical differentiation between these diseases, in the usual absence of facilities for virus studies, is so difficult that the distinction as a rule is invalid, and (2) where facilities for virus studies were available approximately 7 out of 10 such cases studied in the 1943 epidemic revealed influenza virus A as the causative agent.

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1918.—The weekly data of continental shore stations during 1918 show a minor increase of influenza occurring in February, March, and April, reaching a high point late in April.[2] During the summer months of 1918 the usual drop in the influenza rate occurred with the year's low point being reached late in July. In the fall of that year, influenza began to appear in epidemic proportions, first at the Receiving Ship, Boston, Massachusetts, and soon extending throughout the 1st Naval District. The incidence of this disease in all continental shore stations rapidly rose from a seasonal low early in August to its peak in the week ending 21 September, and then subsided with equal rapidity.

1943 COMPARED WITH 1918

Influenza.—When the combined annual admission rates per 1,000 strength by week for acute catarrhal fever and influenza during 1943 are plotted against comparable rates for 1918 (see graph), the following observations suggest themselves:

1. Except for the autumn months during which the pandemic of 1918 occurred, the incidence of influenza in 1943 was almost persistently higher than that in 1918. This remains true despite the previously mentioned increase in the early spring months of 1918. It is quite clear that in 1943 this disease failed to follow a truly typical seasonal pattern.

2. The difference in time periods of peak points, autumn in 1918 and winter in 1943, illustrates one characteristic which differentiates a pandemic from an epidemic. The peak in 1918 was reached during the week ending 21 September with a rate of 3,015 per 1,000. This was almost five and one-half times greater than the peak of 1943 (555) which occurred in the week ending 11 December.

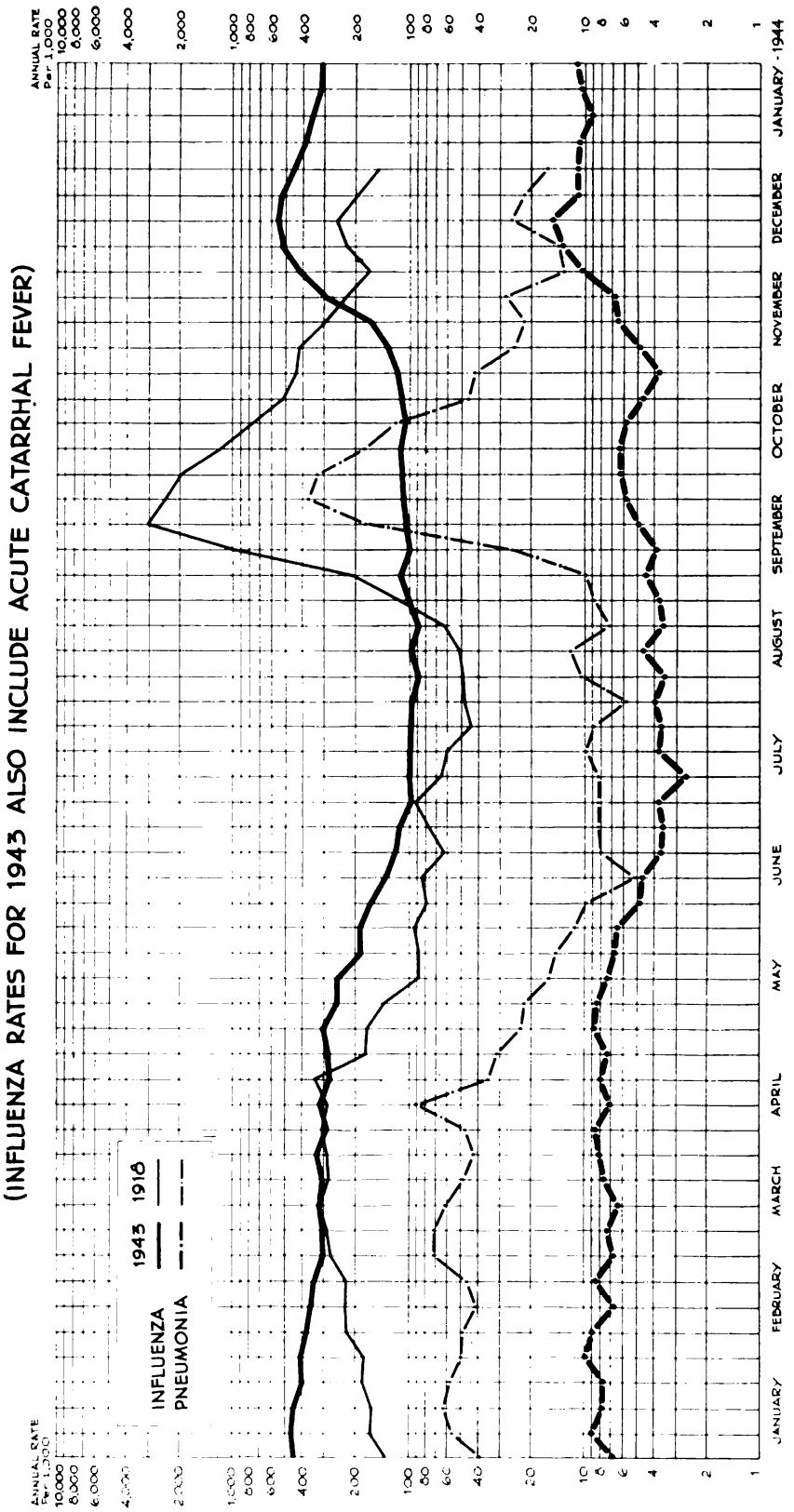
3. The pandemic of 1918 covered a total period of 14 weeks from the beginning of the rise to complete recession to what may be considered normal. In the short period of four weeks, the rate rose precipitously from a summer low of 62 per 1,000 to the pandemic peak of 3,015.

On the other hand the graph seems to indicate that the beginning of the 1943 rise took place during the week ending 28 August. It rose slowly through the succeeding 8 weeks and then increased more rapidly for an additional 8-week period, attaining its peak in the week ending 11 December. Thus it would appear that a period of 16 weeks elapsed before the rising curve reached its highest point. Seven weeks after the peak of 555, the rate had not receded below 300 per 1,000.

Pneumonia (all forms).—Examination of the annual admission

[2] The consensus in 1919 was that this increase constituted a minor epidemic. The epidemic was primarily restricted to personnel on ships in European waters, but many scattered outbreaks also appeared in the United States.

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rates per 1,000 for pneumonia (all forms) plotted week by week for the years 1918 and 1943 yields the following data:

1. During both years the pneumonia rates roughly parallel those for influenza but at a much lower level.

2. When compared with 1918 the pneumonia incidence for 1943 is relatively unimportant. At no time during the 52 weeks of the year does the 1943 pneumonia rate exceed the 1918 rate, and only during the summer months do the two approach the same level.

3. In 1918, during the pandemic period, the rise in the pneumonia curve was at a rate of increase that was greater than that shown for influenza; the fall of this curve was also at a greater rate of decrease. This was not the case in 1943.

Though the figures are not yet available, it is obvious that the pneumonia mortality in 1943 was very low, much lower than in 1918. Credit for this fact should apparently be given first to the sulfonamides, second to penicillin, and third to type-specific anti-pneumococcus serum.

CONCLUSIONS

Compared with the 1918 pandemic of influenza the recent (1943) epidemic of influenza was relatively insignificant.

The 1943 epidemic differed from the 1918 pandemic in that: (1) It did not develop as abruptly, reach such great proportions, or recede as rapidly; (2) it did not occur in a month outside the usual seasonal range for respiratory disease epidemics; and (3) it was not accompanied by a sharp rise in the pneumonia rate.



DICOUMARIN: INDICATIONS AND CONTRAINDICATIONS

1. Dicoumarin is valuable in the treatment of *thrombosis* and *embolism*. Its effect should be maintained for at least four weeks.

2. Dicoumarin may be used for the treatment of all cases for which heparin is advocated.

3. Dicoumarin should be used with caution, or not at all, in cases associated with ulcerating lesions.

4. Dicoumarin should not be used in bleeding patients.

5. It should not be used in cases in which the prothrombin time is already prolonged (vitamin K deficiency).—DAVISON, F. A.: Synopsis of Materia Medica, Toxicology, and Pharmacology. 3d edition. The C. V. Mosby Co., St. Louis, Mo., 1944. p. 663.

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ADMINISTRATION OF A NAVY DEPENDENTS' UNIT

A PLEA FOR COORDINATION

JOHN B. POLLARD
Captain (MC) U. S. N.

ALBERT T. WALKER
Captain (MC) U. S. N.

PAUL PETERSON
Commander (MC) U. S. N.
and
CHARLES L. BUXTON
Lieutenant Commander (MC) U. S. N. R.

With the vast increase of the dependent population of the Navy, the Naval medical personnel has had to assume the responsibility of caring for a large number of obstetric, gynecologic and pediatric cases. This has involved the establishment of many "dependents' units" all over the country, some in Naval hospitals, and many in cooperation with civilian hospitals. Because of the rapid growth of these units, the process of handling patients, the chart forms, the mechanical facilities and equipment are almost as many and varied as the units themselves.

The technic of administration of one of these units is presented not as the ideal example of how all should be managed, but as the basis for constructing a system which might be made available for future use in these activities. In the first 9 months after the establishment of this unit a routine was evolved for the care and management of patients which has proved quite satisfactory.

All out-patients are seen in the Naval Academy Dispensary which is in another building from the hospital. Any out-patient who is to be admitted to the hospital is investigated concerning dependent status and finances by a nurse at the dispensary and a request that the patient be admitted is sent on a written form from the chief of the dependents' service to the medical officer in command of the Naval hospital (form 1). Authorization having been granted by the commanding officer, the patient is then admitted. In case of emergency this process is carried out by phone. Although this may appear to be a somewhat awkward procedure, it is necessary, as the dispensary and hospital are under different commands and the commanding officer of the hospital is thus kept informed of and has control of hospital admissions.

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REQUEST FOR HOSPITALIZATION OF DEPENDENTS

Authorization is requested to hospitalize ..... (Name) ..... (Age)

Diagnosis ..... Estimated length of hospitalization .....

Patient is dependent of ..... (Name) ..... (Rank or rating)

..... (Address)

Have instructions contained in "Plan for Hospitalization of Dependents", paragraph 1(f), 2 and 3, relative to financial arrangements been complied with? [] YES [] NO.
Dependent status verified.

..... (Chief of Dependent Service)

From: Medical Officer in Command, U. S. Naval Hospital, Annapolis, Maryland.
To: Chief of Dependent Service.

1. Request for hospitalization ..... approved.

U.S.N.A.—12-7-43—1000

Form 1.

The patient is then sent to the hospital with a memorandum for admission (form 2) and with admission orders. In the case of obstetric patients, a paper is provided containing any information about their antepartum course which will be of value to the admitting doctor (form 3). This sheet is attached to the chart at the time of admission and space is provided on the sheet for continuation notes concerning labor and delivery.

In a unit where the out-patient department and hospital are in the same building, under the same command and the patient's antepartum chart is available, this sheet is unnecessary. However, even though the obstetric patients here are delivered by the doctor who had followed them through their antepartum course, it is necessary to have available a résumé of the patient's history.

All the medical officers on duty at the dispensary are assigned to additional duty at the hospital so that they may follow their own cases on admission. The medical officers at the hospital are available for consultation if desired.

In the dispensary an attempt is made to enable each medical officer to confine himself to his own specialty as much as possible and to follow each patient as a private patient rather than on a clinic status. All children are given health records with a history of medical progress and various prophylactic immunizations.

All obstetric patients are assigned to one of the two obstetric specialists in the dispensary and are followed through their antepartum course, delivery and postpartum care by one physician, a plan desirable from both the patient's and physician's point of view. These

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UNITED STATES NAVAL ACADEMY

ANNAPOLIS, MARYLAND

OUT PATIENT SERVICE

Date_____.

Memorandum to the Officer of the Day,
U.S. Naval Hospital,
Annapolis, Maryland.

Admit_____Dependent _____ of
Relationship

_____, _____.
Name Rank or Rate

Financial requirements have been complied with.

_____
Chief of Service

Admission Orders

_____

Form 2.

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U. S. NAVAL HOSPITAL
ANNAPOLIS, MARYLAND

OUT-PATIENT SERVICE
LABOR RECORD

PRENATAL SUMMARY: Date..... PARA..... GRAVIDA.....

Name..... Age..... L.M.P..... E.D.C.....

Kahn..... reaction date

Evidence of Toxemia?.....

Pelvic Type ..... Abnormalities .....

Prognosis and Remarks.....

.....

.....

LABOR SUMMARY: **Time of Delivery:** Date..... Hour.....

Date	Hour	B.P.	Position and Station	F.H.	Cervix	Memb.	Contractions	R or V	Medication	Initial

DESCRIPTION OF DELIVERY:

.....

.....

.....

(CONTINUE ON OTHER SIDE)

U.S.N.A.—4-9-43—3000

Form 3.

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patients are provided with an obstetric chart (forms 4 and 5) providing space for entry of complete obstetric data, and should the patient move to another dependents' unit, as so frequently happens, a copy of the chart is given to her. In fact, an attempt is made to provide every patient who has been treated in the dispensary with a copy

UNITED STATES NAVAL ACADEMY
Annapolis, Maryland
MEDICAL DEPARTMENT

PREGNANCY RECORD

NAME..... AGE..... RACE..... DATE.....

ADDRESS..... M. S. W. D..... PHONE.....

HISTORY

L. M. P..... Expected date..... Para..... Gravida.....

Previous Pregnancies No..... Full Term..... Premature..... Abortion.....

Preg. No.	Date	Place	Delivery	Duration Labor	Complications	CHILD		REMARKS
						Wt.	Condition	
1.								
2.								
3.								
4.								
5.								

Family History .....

Past History & Operations.....

Father of Baby..... Age..... Health..... Rank or Rate.....

Menses. Onset..... Yrs., Interval.....days, Duration..... days, Amount.....

Pain .....Remarks .....

PRESENT PREGNANCY

Nausea..... Vomiting..... Constipation ..... Headache.....

Edema..... Bleeding..... Leucorrhea ..... Fainting.....

Backache..... General Health..... Usual weight .....

Remarks .....

Form 4.

of her chart when she leaves for another locality. This is especially true of surgical and gynecologic cases as past history is so often of great importance. Because of the peripatetic nature of dependents' lives it would be highly desirable to provide them all with a standard health record, such as that used by actual Naval personnel.

The obstetric charts which patients carry with them from station to station are many and varied, differing markedly in content and for-

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PHYSICAL EXAMINATION

Appearance ..... Skin ..... Height ..... Weight .....

Nose and Throat ..... Teeth ..... Thyroid .....

Heart .....

Lungs .....

Breast: Shape ..... Skin ..... Consistency ..... Nipples .....

Abnormalities .....

Abdomen: .....

Pendes ..... Position ..... F. H. ..... Engagement ..... Disproportion .....

Pelvis Examination-Outlet ..... Ovarys .....

Cervix .....

Corpus Uteri .....

Adnexa .....

Discharge .....

Interspinous ..... cm.

Intercristal ..... cm.

Bi. Conjugate ..... cm.

Symphysis ..... Height ..... Inclination .....

Pubic Arch ..... Width ..... Shape .....

Promontory ..... Side Walls .....

Sacrosciatic notch ..... Ischial spines .....

Prognosis .....

Remarks: .....

.....

.....

Signed .....

Rule Reaction .....

RETURN EXAMINATIONS

Date	Wt.	B. P.	Urine	Pendes	Pos.	F. H.	REMARKS
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							

Remarks: .....

Form 5.

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mat. These charts are devised, just as ours are, by the medical officer at the station where the patient was last examined. At some dispensaries she is given her original chart and no record is kept of her medical history. At other dispensaries she is given a copy of her chart and at still others she receives no medical record whatever to take with her. It is thought that efficiency and simplification of the patients' care would be considerably improved by the development of a standard chart which could be made available for all dependents' units.

Following admission of obstetric patients to the hospital, they are examined by the intern, who under the supervision of the attending medical officer, follows them through labor. Various types of analgesia are used including nembutal and scopolamine, rectal evipal and continuous caudal. Attempts are made to make the analgesia appropriate to the patient's physical and mental condition. Deliveries are conducted by the intern and the obstetrician who has followed the patient throughout her antepartum course and the baby is put immediately under the supervision of the pediatrician.

WAVES are instructed in sterile obstetric technic and delivery room activities, and they scrub for all deliveries. They are also instructed in postpartum care and under the supervision of the nursing staff attend all patients during the postpartum period, having been taught the technic of catheterization, enemas, etc. Considerable time has been spent in teaching WAVES nursing care because the obstetric service is so small that it has to be placed in the same unit as the medical and surgical services, and there is no isolation unit.

Between the months of May and November 1943, 103 patients were delivered at this hospital, an average per month which has almost doubled since that time.

With the dependents' units in the Navy handling collectively such a large number of patients every year—certainly many times more than any civilian organization—it would seem of great importance to keep accurate vital and obstetric statistics of a uniform type in all units, not only because of their public health value but also because it is the only way in which the Navy can be sure it is maintaining satisfactory obstetric standards.

SUMMARY

The management and activities of a dependents' unit are reviewed with discussion of treatment in dispensary, technic of admission to hospital, and hospital care.

The desirability of uniformity of chart forms and of other features of dependents' care in all units is discussed.

A plea is made for uniform statistical obstetric analyses throughout the Navy.

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RECENT OUTBREAK OF SALMONELLA FOOD INFECTION[1]

While at sea on 23 January 1944 the crew of a large auxiliary vessel suffered a severe outbreak of food infection which affected 204 of the total 460 enlisted men aboard. Of the 204 who became ill, 142 were admitted to the sick list and 62 were treated as ambulatory patients. There were mild, moderately severe, and severe cases, the moderately severe cases being in the majority.

The outbreak began on the evening of 23 January and cases continued to develop with symptoms of nausea, vomiting, diarrhea, headache, extreme weakness, and fever until late in the morning of 25 January. The evening meal of 23 January and breakfast of 24 January were eliminated as responsible for the outbreak, due to the fact that 39 of those taken ill did not eat the evening meal and 46 dated the onset of their illness prior to breakfast of 24 January. This pointed to the noon meal of 23 January as being the source of the infection. The incubation period for the infection appeared to vary between 7 and 72 hours, with the greatest number of cases occurring after a 21- to 30-hour incubation period (table 1).

TABLE 1.—*Number of patients reporting after specified incubation period*

[From histories available in 186 cases]

Hours after suspected meal	7–10	11–20	21–30	31–40	41–50	51–60	61 plus
Number of ill patients reporting	23	57	77	11	11	3	4

This comparatively long incubation period, coupled with the fact that high temperatures were frequent and prolonged, eliminated the probability of a staphylococcic enterotoxin as the cause of the outbreak and pointed to infection by some member of the salmonella group.

A statistical study of the foods eaten and not eaten at the noon meal of 23 January by the persons who later became ill, revealed that turkey was the only food eaten by all (table 2). It is unfortunate that similar data for persons who ate this meal and failed to become sick were not reported. The evidence, however, appeared to point to the turkey as the most likely source of the infection, and investigation was therefore centered on this item of the menu.

[1] Abstracted from Special Epidemiological Report submitted by COLE, G. M., Lieutenant (MC) U. S. N.

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From the galley personnel the following facts were elicited regarding the preparation of the turkey. It had been prepared for baking in the evening of 22 January and roasted at a temperature of 350° F. The first turkeys were taken out of the ovens at midnight 22 January and were kept in open containers in the galley until 0800 next morning. At this time the turkey was sliced and placed on the ovens to keep warm. The serving of the sliced meat did not begin until 1130. It would appear, therefore, that much of the meat was subjected to exposure at galley temperature for about 8 hours and to "warming" temperatures for another 3 to 4 hours. (It is of considerable interest that turkeys of the same lot that were roasted and served to officers and warrant officers without any such period of standing in the galley gave rise to no illness.) The reason for roasting the turkey so far in advance of the serving time was that the steam was to be turned off for an hour or more during general quarters at dawn.

TABLE 2.—*Foods eaten and not eaten by men who became ill*

Food	Number eating	Number not eating	Food	Number eating	Number not eating
Soup	81	123	Peas	146	58
Turkey	204	0	Dressing	140	64
Gravy	155	49	Cranberry sauce	133	71
Potatoes	164	40	Salad	80	124
Beans	119	85	Pie	174	30

LABORATORY STUDIES

Fifty-three stools from acutely ill patients were examined. They were streaked on sodium desoxycholate citrate media; suspected colonies were inoculated into fermentation tubes. Gram stains and motility tests were done on all suspected colonies. Nonlactose-fermenting colonies were kept for 5 days.

Thirteen cultures resembled salmonella very closely; six of these proved to be gram-negative rods, motile, nonlactose-fermenting, and fermenting dextrose and xylose with acid and gas. Agglutination studies on one of the cultures showed it to be Salmonella gaminara (antigenic formula XVI:d:17).

No food handlers were found to be carriers of this salmonella.

Unfortunately no samples of the turkey remained for bacteriologic studies and positive evidence of the infection of the turkey with salmonella is therefore lacking. The assumption is that certain of the turkeys were infected with Salmonella gaminara prior to roasting, that the roasting process did not completely kill all the salmonella, that slicing the turkey spread the salmonella through the meat, and

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that leaving the meat at "warming" temperatures for 3 to 4 hours served to incubate the organisms spread by the slicing.

CLINICAL COURSE

Seven to 72 hours after ingesting the noon meal of 23 January the onset of nausea, vomiting, and diarrhea occurred. In some of the cases the infection took a mild course, producing only abdominal cramps, headache and a mild diarrhea of 3 or 4 brownish watery stools in 24 hours; in others the stools were very watery and numerous, some of the patients having as many as 25 to 30 in 24 hours. Most patients showed a temperature rise; 108 of the 142 patients admitted to the sick list had temperatures over 102° F.; 9 patients had temperatures over 104° F. Over a period of 9 days the temperature returned to normal in all cases. Several patients collapsed from weakness while attempting to carry on their duties. Almost all complained of severe headache, backache, and joint ache.

Sulfadiazine was given to 69 of the 142 patients admitted to the sick list. This drug, however, exerted no noticeable influence in lowering the temperature. The injection of intravenous fluids was found necessary in several of the more severely dehydrated patients. In certain cases with high temperatures a sharp fall in the temperature was observed to follow the intravenous administration of fluid. Some of the patients continued to have several watery stools daily even though their temperatures had returned to normal and 6 or 7 days had elapsed since onset of symptoms. Because of extreme weakness the return to normal was rather slow in almost all cases.

SUMMARY

1. A recent outbreak of food infection involved 204 of 460 enlisted men aboard a large auxiliary craft. Excluding the hours lost from "watch" there were approximately 9,000 man-hours lost as the result of this one outbreak.

2. The microorganism involved in the outbreak was the Salmonella gaminara.

3. The food that carried the salmonella was apparently turkey which had been sliced and then permitted to stand warm for 3 or 4 hours.

4. This outbreak served to reconfirm:

(a) That after cooking, and particularly after slicing or handling, roast fowl cannot safely be kept in or on warming ovens.

(b) That after slicing, roast fowl should either be immediately served, or spread in shallow trays and refrigerated until just before serving time when it may be taken out of refrigeration, heated and promptly served.

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(c) That the incubation period of Salmonella gaminara food infection varies between 7 and 72 hours.

(d) That Salmonella gaminara food infection patients may have temperatures of 104° F. and higher and that it may take as long as 9 days for these infections to run their course.

FOOD POISONING

The following is the report of a minor outbreak of food poisoning at this hospital. There were a total of 46 known cases which were for the most part confined to three wards.

The symptoms developed in from 3 to 10 hours following the evening meal, the onset of the majority of the cases being from 4 to 6 hours after this meal was served. The onset was sudden with nausea and vomiting, abdominal cramps, watery diarrhea, and prostration. Those affected had from 5 to 20 watery stools which showed mucus macroscopically. One specimen revealed blood. There was no fever. The duration was brief, the longest persisting for 36 hours.

The evening meal consisted of sliced turkey, dressing, sliced raw tomatoes, lima beans, sliced bread, butter, milk, and doughnuts. The turkey had been cooked 48 hours before and served for the noon meal on the next day. It was then stored and served again during the evening meal prior to the outbreak.

During the investigation a total of 65 food handlers and galley workers were examined. This examination consisted of a history, physical examination, and bacteriologic studies. The history was noncontributory except for the fact that 6 had diarrhea during the course of this outbreak. None gave histories of previous typhoid fever or chronic diarrhea.

The physical examination consisted of examination of the hands, forearms, and face for the presence of pustular lesions which might contain a strain of staphylococcus capable of producing enterotoxin. One food handler, a worker in the butcher shop, had an infected laceration on his hand. Pus from this lesion was cultured on blood agar plates and a hemolytic staphylococcus was recovered.

Sixty-four stool specimens from food handlers were examined. Emulsions of these were streaked on selective and differentiating media. Colonies which appeared to be suspected were then planted on Russell's double sugar medium. Suspected organisms were inoculated into various carbohydrate liquid media for the determination of fermentation reactions. No pathogenic organisms were recovered. Microscopic examination of smears from the stools was not enlightening.

Culture from the turkey showed growth of a hemolytic staphylococcus.—JONES, J. P., Lieutenant (MC) U. S. N. R.

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Anderson, Earl M., Lieutenant (MC) USNR (*Arthrotomy of the Knee*, p. 1314). B. S., 1938, and M. B., 1940, University of Minnesota; M. D., University of Minnesota Medical School, 1941. Intern, Minneapolis General Hospital, July 1940–Jan. 1942. Fellow in surgery, Mayo Foundation, 1942; member: Minnesota State Medical Association, Olmsted-Houston-Fillmore-Dodge Counties Medical Society.

Anderson, Truman O., Lieutenant Commander (MC) USNR (*Antiseptic Applicator for Use with Morphine Syrette*, p. 1421). M. D., Hahnemann Medical College, 1918. Intern: Hahnemann Medical College Hospital, May 1917–May 1918; Eye, Ear, Nose and Throat Service, U. S. Naval Hospital, Great Lakes, June 1918–Jan. 1919; Nose and Throat Clinic, Hahnemann Medical College Hospital, June 1919–Aug. 1921; Illinois Charitable Eye and Ear Infirmary, 1921–22; Illinois Post Graduate Hospital, 1922–23; eye surgeon for: Chicago Bridge and Iron Works; Sherwin Williams Co.; Van Etten Bros. Contractors; Great Lakes Forge Co., Chicago; private practice, Chicago, 1919–; staff member, Roseland Community Hospital, Chicago. Member: Chicago Medical Society; Illinois State Medical Society; American Medical Association.

Blum, Lester, Lieutenant Commander (MC) USNR (*Myotomy in the Repair of Divided Flexor Tendons*, p. 1317). M. D., Columbia University College of Physicians and Surgeons, 1930. Intern, Lenox Hill Hospital, 1931–32; resident surgeon, Beekman Hospital, New York, N. Y., 1933; associate attending surgeon, New York City Hospital, Welfare Island; Beekman Hospital. Fellow: American College of Surgeons; American Medical Association; New York Academy of Medicine. Diplomate American Board of Surgery.

Buxton, Charles L., Lieutenant Commander (MC) USNR (*Administration of a Navy Dependents' Unit*, p. 1441). B. S., Princeton University, 1927; M. D., 1932, and Med. Sc. D., 1940, Columbia University College of Physicians and Surgeons. Intern, Sloane Hospital for Women, New York, N. Y., 1933–34; research fellow in anatomy, Harvard Medical School, 1934–35; resident in pathology, ob-

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stetrics, and gynecology, 1935–38, and assistant attending obstetrician and gynecologist, 1938–, Sloane Hospital for Women; instructor in obstetrics and gynecology, Columbia University College of Physicians and Surgeons, 1938–. Member: American Medical Association; Harvey Society; Association for the Study of Internal Secretions. Diplomate American Board of Obstetrics and Gynecology.

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Cooper, Clark N., Lieutenant Commander (MC) USNR (*Acute Appendicitis Afloat*, p. 1334). B. S., State University of Iowa; M. D., State University of Iowa College of Medicine, 1928. Intern, Cincinnati General Hospital, Cincinnati, Ohio, 1928–29; assistant resident, surgery, 1929–32, and resident surgeon, 1932–33, University Hospitals, Iowa City, Iowa; associate surgeon, State University of Iowa College of Medicine and University Hospitals, 1933–34; surgical staff, St. Francis Hospital and Allen Memorial Hospital, Waterloo, Iowa. Fellow: American College of Surgeons; American Medical Association. Member Iowa State Medical Society. Diplomate American Board of Surgery.

Deaver, J. Montgomery, Captain (MC) USNR (*Preparation and Uses of a 6-Percent Sulfanilamide Ointment*, p. 1407). B. S., Yale University, 1924; M. D., University of Pennsylvania School of Medicine, 1928. Chief of surgical service: Children's Hospital of the Mary J. Drexel Home, Philadelphia, Pa., and Surgical Service "A", Lankenau Hospital; visiting surgeon, Abington Memorial Hospital, Abington, Pa.; associate in surgery, Graduate School of Medicine, University of Pennsylvania School of Medicine; instructor in surgery, University of Pennsylvania School of Medicine. Fellow: American College of Surgeons; American Medical Association; member American Surgical Association. Diplomate American Board of Surgery.

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Finn, Herbert G., Lieutenant (MC) USNR (*Surgical Treatment of Severe Mumps Orchitis*, p. 1388). A. B., Harvard University, 1928; M. D., Harvard Medical School, 1932. Surgical intern, Boston City Hospital, 1932–34; private practice, general and industrial surgery, Boston, 1934–; port surgeon in Boston for: Lykes Brothers Steamship Co., Galveston, 6 yrs.; Ocean Steamship Co. of Savannah, 1941; industrial surgeon for Peabody & Lane, 6 yrs.; Nacirema Operating Co.; Atlantic & Gulf Stevedores, 6 yrs.; industrial surgeon: H. P. Hood & Sons; United Farmers Cooperative Creamery Association, Inc.; examining physician: Massachusetts Institute of Technology; Boston Post Publishing Co.; Boston Globe Publishing Co.; surgical staff: Carney Hospital, Boston, 1939–; St. Elizabeth's Hospital, Boston, 1935–. Fellow American Medical Association; member Massachusetts Medical Society. Diplomate National Board of Medical Examiners.

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Greeley, Paul W., Lieutenant Commander (MC) USNR (*Reconstruction of the External Ear*, p. 1323). M. D., Northwestern University Medical School, 1927. Intern, Evanston Hospital, Evanston, 1927–28; assistant to Dr. Frederick Christopher, 1928–31; voluntary assistant to Sir Harold Gillies, London, England, 1935; postgraduate work, plastic and reconstructive surgery, Freiburg University, Heidelberg University, Munich University, and Vienna University, 1935; attending plastic surgeon: University of Illinois Research and Education Hospitals and St. Luke's Hospital, Chicago; assistant professor, surgery, and chief of the Division of Plastic and Reconstructive Surgery, University of Illinois College of Medicine. Fellow: American College of Surgeons; American Medical Association; member: American Society of Plastic and Reconstructive Surgery; American Association for the Surgery of Trauma; Central Surgical Association; Chicago Surgical Society; Institute of Medicine of Chicago; Mississippi Valley Medical Society; Illinois State Medical Society; Chicago Medical Society. Diplomate American Board of Plastic Surgery.

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Kaplan, Abraham, Commander (MC) USNR (*Tantalum in Repair of Extensive Injury of the Forearm*, p. 1391). B. S., Harvard University, 1923; M. D., Harvard Medical School, 1927. Associate neurosurgeon: Mount Sinai Hospital, Bellevue Hospital, Hospital for Joint Diseases, New York City. Fellow: American College of Surgeons; American Medical Association; member: New York State Medical Society; New York Neurological Society. Diplomate: National Board of Medical Examiners; American Board of Neurological Surgery.

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Knapp, Arthur Alexander, Commander (MC) USNR (*Corneal Graft or Tattooing with Iridectomy?* p. 1366). M. D., University and Bellevue Hospital Medical College, 1926. Eye intern, Presbyterian Hospital, New York City, 1929–31; assistant eye surgeon, New York Eye and Ear Infirmary; research ophthalmologist, Department of Pharmacology, Columbia University, for several projects during 1931–38; assisting visiting eye surgeon and ophthalmologist, Arthritis Clinic, Hospital for Special Surgery (formerly Hospital for Ruptured and Crippled); associate ophthalmologist, Montefiore Hospital for Chronic Diseases, 1931–40; director of eye service, Sing Sing Prison Hospital. Fellow American College of Surgeons; member: American Medical Association; Association for Research in Ophthalmology; American Academy of Ophthalmology and Oto-Laryngology; New York Academy of Medicine.

Krueger, Albert Paul, Captain (MC) USNR (*Laboratory and Field Studies of Glycols and Floor-Oiling in the Control of Air-Borne Bacteria,* p. 1288). A. B., Stanford University, 1925; M. D., Stanford University School of Medicine, 1928. Assistant bacteriologist and experimental pathologist, Stanford University, 1927–28; acting instructor, 1928–29; instructor and assistant professor, 1929; associate, general physiology, Rockefeller Institute, 1929–31; associate professor, bacteriology, University of California, 1931–38; consultant, communicable diseases, Student Health Service, and lecturer, medicine, University of California, 1932–; assistant visiting physician, University of California Hospital, 1931–; consultant bacteriologist, 1932–; professor of bacteriology, University of California, 1938–; grant, cmt. scientific research, American Medical Association, 1938. Fellow American Medical Association; member: A. A.; Society of American Bacteriologists; Society of Experimental Biology; American Society for Experimental Pathology; American Association of Immunologists.

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Matzner, Milton J., Commander (MC) USNR (*Postvaccinal (Yellow Fever) Jauntice,* p. 1381). B. S., 1920; Ch. E., New York University, 1923; M. D., Columbia University College of Physicians and Surgeons, 1925. House physician, Mt. Sinai Hospital, New York City, 1925–27; Emanuel Libman Traveling Fellowship (Mt. Sinai Hospital), pathology, Vienna, 1927–28; private practice, Brooklyn, 1928–41; associate attending physician, Brooklyn Cancer Institute (Kings County Hospital), Brooklyn, 1940–; adjunct physician, Jewish Hospital, Brooklyn, 1928–. Associate fellow American College of Phy-

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Milles, George, Lieutenant Commander (MC) USNR (*Advantages and Limitations of Intravenous Sodium Sulfathiazole*, p. 1283). Ph. G., 1921, B. S., 1925, University of Illinois; M. D., 1929, M. S. (pathology), 1932, University of Illinois College of Medicine. Intern, Kings County Hospital, Brooklyn, N. Y., 1927–30; assistant professor of pathology (on leave of absence), University of Illinois; director of laboratories, Augustana Hospital, Chicago; staff member: Augustana Hospital; Lutheran Deaconess Home and Hospital, Chicago. Fellow American Medical Association; member: Illinois State Medical Society; Chicago Medical Society; Chicago Pathological Society; American Society for Clinical Pathologists. Diplomate American Board of Pathology.

Parker, Leon O., Commander (MC) USNR (*Sprained Ankles*, p. 1309). B. S., Indiana University, 1924; M. D., Indiana University School of Medicine, 1926. Intern, Public Health Service, 1926–30; assistant in orthopedic surgery, Stanford University Medical School, 1931–35; University of California Medical School, 1936–42; visiting specialist, orthopedic surgery, U. S. Marine Hospital, 1934–42; associate, orthopedic surgery: Mary's Help Hospital and French Hospital, San Francisco. Fellow: American College of Surgeons; American Medical Association; member: San Francisco County Medical Association; California State Medical Association; Western Orthopaedic Association.

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Sager, W. Warren, Commander (MC) USNR (*Concentrations of Sulfonamides in Wound Exudates Following Oral Administration*, p. 1275). A. B., Washington and Lee University, 1918; M. D., George Washington University School of Medicine, 1922; M. S. in Surgery, University of Minnesota Medical School, 1927. Intern and resident, Central Dispensary and Emergency Hospital, Washington, D. C., July 1922–July 1924; fellow, July 1924–Jan. 1927, and assistant, Jan. 1927–Jan. 1929, Mayo Clinic; associate clinical professor surgery, George Washington University School of Medicine. Fellow: American College of Surgeons; American Medical Association; member Medical Society of the District of Columbia.

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Siris, Joseph H., Lieutenant (MC) USNR (*Postconcussion Syndrome*, p. 1357). A. B., Columbia University, 1928; M. D., Columbia University College of Physicians and Surgeons, 1932. Intern, Bellevue Hospital, New York City, 1933–34; resident, Neurological Institute of New York, 1935–36; resident neurosurgeon, 1937–39, assistant neurosurgeon, 1930–42, and adjunct neurosurgeon, 1942–, Jewish Hospital, Brooklyn; assistant neurosurgeon, 1939–42, and associate neurosurgeon, 1942, Queens General Hospital (Jamaica) New York City; attending neurosurgeon, St. Joseph Hospital (Far Rockaway) New York City, 1940–; consulting neurosurgeon, Long Beach Hospital, Long Beach, N. Y., 1940–; visiting neurosurgeon, Triboro Hospital (Jamaica) New York City, 1941–. Fellow: American College of Surgeons; American Medical Association. Diplomate: American Board of Neurological Surgery; American Board of Psychiatry and Neurology.

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Wilson, Judson D., Commander (MC) USNR (*Tantalum in Repair of Extensive Injury of the Forearm*, p. 1391). B. A., Indiana University, 1926; M. D., Indiana University School of Medicine, 1929. Intern, Indiana University Hospital, 1929–30; orthopedic resident, Ohio State University, 1930–33; private practice, orthopedic surgery, 1933–; assistant professor, orthopedic surgery, Ohio State University; head of orthopedic department, White Cross Hospital, Columbus, Ohio; member of orthopedic staff: Grant, Mt. Carmel University, and Children's hospitals, Columbus, Ohio. Fellow: American College of Surgeons: American Medical Association; member: Columbus Academy of Medicine; Ohio State Medical Association; Academy of Orthopaedic Surgery; Clinical Orthopaedic Society. Diplomate American Board of Orthopaedic Surgery.

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HYPEREMIA IN IMMERSION SYNDROME

The hyperemia of the deeper tissues is due to a sterile inflammatory reaction and tends to disappear after ten to twenty days. In cases of milder injury pain disappears *pari passu* with the return of normal circulation, but in the more severely injured extremities this is, unfortunately, not the case and surface cooling no longer has its beneficial effect.—WHITE, J. C., and WARREN, S.: Causes of pain in feet after prolonged immersion in cold water. War Med. 5: 6–13, January 1944.

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ANESTHESIA DURING SHOCK

Bilateral intercostal nerve block of the 7th through the 11th intercostal nerves in the midaxilliary line combined with intravenous sodium pentothal constitutes an apparently safe and satisfactory anesthesia for abdominal operations on patients in moderate or severe shock (45 patients). Intravenous sodium pentothal alone has been used with success also in 23 shock patients who have suffered severe trauma to the extremities where major surgery had to be done.—EVANS, E. I.: Studies on traumatic shock: III. Anesthesia in clinical shock. J. A. M. A. 124: 473–478, February 19, 1944.

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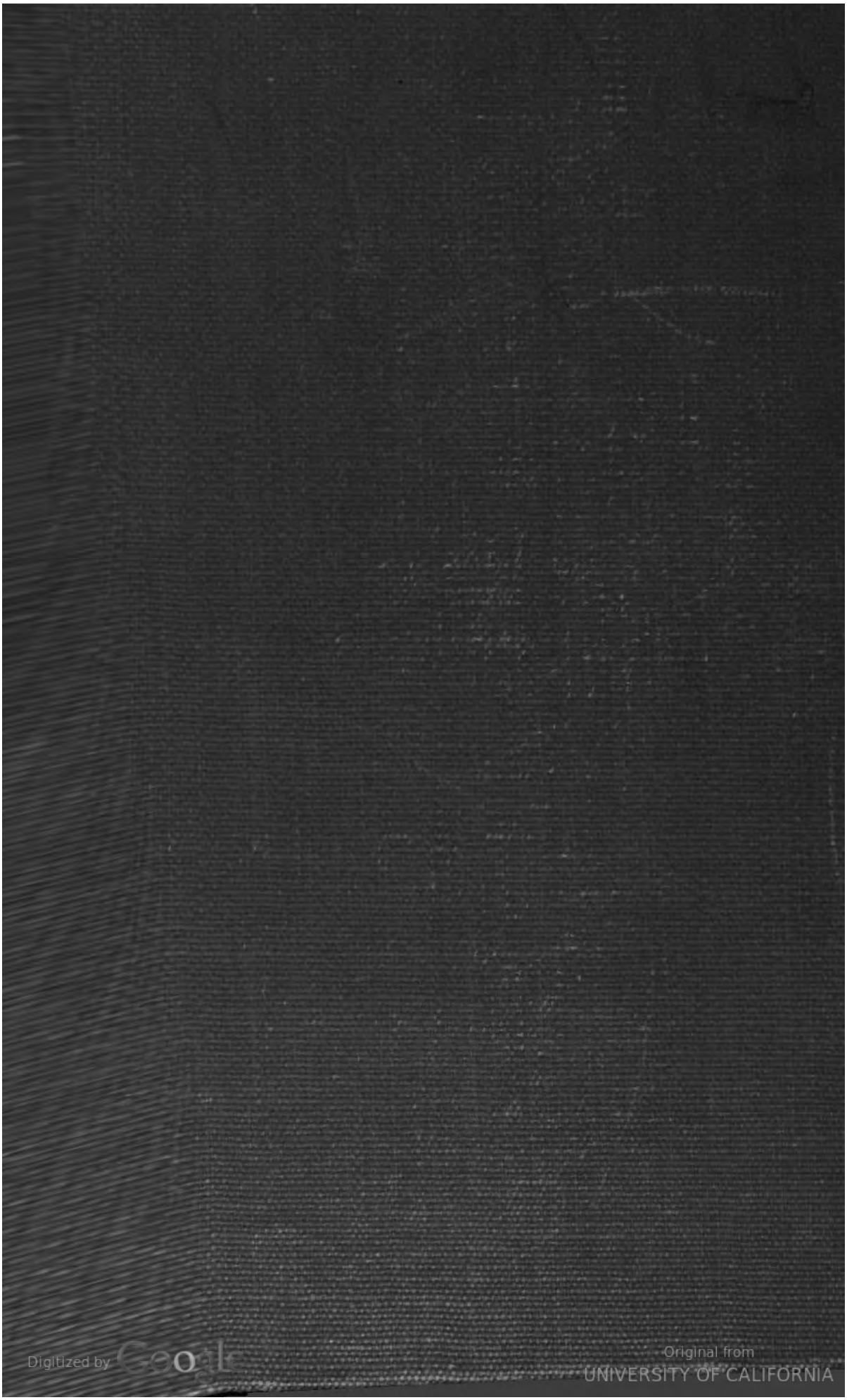
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